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PIESSE'S
MAGIC

CHYMICAL MAGIC.

LONDON
PRINTED BY SPOTTISWOODE AND CO.
NEW-STREET SQUARE

CHYMICAL,

NATURAL, AND PHYSICAL

MAGIC.

INTENDED FOR

THE INSTRUCTION AND ENTERTAINMENT OF JUVENILES

DURING THE HOLIDAY VACATION.

BY

SEPTIMUS PIESSE, PH.D. F.C.S.

AUTHOR OF

'THE ART OF PERFUMERY,' 'THE LABORATORY,'

'YOUNG FARMER'S SCIENCE,' ETC.

RECREATION is intended to the mind as whetting is to the scythe—to sharpen the edge of it, which otherwise would grow dull and blunt. He, therefore, that spends his whole time in recreation is ever whetting, never mowing; his grass may grow and his steed may starve: as, contrarily, he that always toils and never recreates, is ever mowing, never whetting; labouring much to little purpose.

BISHOP HALL.

Third Edition.

LONDON:

LONGMAN, GREEN, LONGMAN, ROBERTS, & GREEN.

1865.

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PREFACE.

EVERY TIME my boys return from school I am called upon to show them some new wonder in the world of alchymy.

There are four of them, and, as the initials of their names are N., S., E., and W., they have obtained from their playmates the soubriquets of NORTH, SOUTH, EAST, and WEST.

NORTH is rather of a cold quiet disposition; nothing seems to put life into him except fire clouds; blue flame and spectral lights are his delight.

EAST is a dry dog. If any stranger calls him 'EAST' he proudly replies 'The wise men came from the east.' To see him swallow an orange (down the sleeve of his tunic) pleases his sister Jessie beyond measure.

When there is a pound of cherries or a box of lozenges to divide, WEST 'calculates' that he knows exactly how many there will be for each of his

brothers and sister, and to whose pocket the odd, by accident, falls.

SOUTH is a warm-hearted, merry fellow, sharp as a rose-thorn, quick as the flutter of a gnat's wing. He passes a shilling through the table so dexterously that I am tired of hearing (when we have our Christmas party) one and another say 'Do it again,' while vainly trying to 'find him out.'

Now, I have had to provide amusement for these four boys, and also for one little girl, their sister; and how I accomplished my task is shown by this tiny book.

I always 'took to children,' and like them to be round and about me even to riper years. Thus it may easily be conceived that I soon fell into the belief that if home was made the happiest place, my children would not be likely to 'seek' amusement elsewhere, and so, practically, I have found it, and the American Colonel's words to them are true, 'There is no place like Home.'

Some author (*Notes and Queries* will perhaps find him out for me) has said that 'Youth are alike in all nations'—that the children of the Chinese, that the boys of Boston, that the lads of Lapland, or the youth of Yucatan, all play alike and at the same games, and the same things amuse *them.*

Backed by this assertion, and knowing how well I have pleased my own children, I now send these puzzles, experiments, recreations, and magic leger-demain on the errand to amuse others who have not yet smiled at them.

If I succeed in giving entertainment I shall soon have to increase the circle of my little friends, and, when I am borne to the grave, may children be my mourners.

A few of these pastimes were in print before the writer was born, and will be found in Hooper's 'Rational Recreations,' published in the last century. All such are, however, re-written—not better, perhaps, but in modern language.

Many readers of the popular periodicals will recognise in the following pages much that has already passed before them, from the fact that I have from time to time 'contributed' these articles for their amusement. Herein I have brought them together to please the present and future generations of youth, who seem determined to make their appearance in geometrical proportion as TIME produces beards, that he may cut them off with his ever-whetted scythe when they become grey.

SEPTIMUS PIESSE.

CHISWICK, W.

PREFACE

TO

THE THIRD EDITION.

FOLLOWING my original plan, as my children have grown older I have placed before them interesting subjects which require more mental labour to understand than those which they formerly had to consider.

These additions will, I trust, render the present edition of my book more entertaining and more deserving of public patronage.

Letters which persons of distinction have kindly honoured me with have induced me to rewrite or further to explain several things which were not clearly understood in former editions. The book therefore in its present shape will, I hope, in every respect be considered greatly improved.

SEPTIMUS PIESSE.

CHISWICK, W.

NOTICE.

THE difficulty of procuring the various Chymical, Optical, Galvanic, and Philosophical Apparatus at a moderate cost, induces the author to mention the following Houses in London worthy of patronage:—

For Chymical Products, Rare Metals, &c.
Messrs. DYMOND, BOLTON, & Co., 146 Holborn Bars.

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Those readers who desire to possess Mechanical Tricks for Legerdemain may obtain them from

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Mr. CREMER, 10 Bridge Street West, Westminster.
Mr. SPRATT, 1 Brook Street.
Mr. SPURIN, 37 New Bond Street.

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CHYMICAL,

NATURAL, AND PHYSICAL

MAGIC.

1. *Musical Glasses.*

When a clean wet finger is passed round the brim of a goblet a pleasing vibration is produced, and the sound is purer, more musical, than when the glass is struck. This fact has led to the construction of a cheap musical instrument, upon which those who have an ear for music may easily play simple airs, and thus amuse themselves and their friends. Any air can be played in the compass of an octave; thus, eight goblets will make a set, or, better still, twelve will extend to an octave and a half. The best form of goblet is the bell shape, uncut, and having a foot. The goblets must vary in size; the large ones forming the bass notes, the smaller the treble. If the tones

of the glasses are required to be very correct, they must be selected and compared with the notes of musical strings, minute variations being readily corrected by placing more or less water in each goblet. Thus tuned, make a mark to where the water reaches, in order to save the trouble of future tuning. Now fix the glasses about an inch apart in an oblong tray, and they are complete to perform upon. Clean the hands from grease with soap and pumice-stone, so that the fingers may be more sensitive to touch. Wet them frequently, and draw them over the glasses according to the sound or musical note required, and by passing them rapidly from brim to brim harmony is readily produced. Though such instruments are now rarely seen, we may infer, from what Goldsmith says in the 'Vicar of Wakefield,' that they were in use a century ago. 'They talk,' says Goldsmith, 'of nothing but high life and other fashionable topics, such as pictures, taste, Shakspeare, and the musical glasses.'

2. *Holiday Experiments for Christmas Eve.*

Once more I am informed that 'the Christmas holidays will commence;' once more SOME ONE tells me that I really ought to do something to amuse the children when they come home; once more SOME ONE says, 'If you will only keep the

children quiet in the parlour, while I get the things ready in the kitchen, we shall all be able to have a comfortable round game on New Year's Eve.' Under the circumstances, can I refuse to do my best to please all? Children (may I not say young people, too?) are amused and entertained much easier than is generally supposed.

I take a tumbler of cold water, and let fall into if a drop of ink; and lo! instead of the ink being black, you see it has a beautiful purple colour. I now let fall into the inky water a pinch of salts of sorrel (a pennyworth will do for a hundred experiments), the colour of the ink disappears, and the water again becomes transparent and bright.

I take a lemon or an orange; with a sharp knife I peel it very thin. Holding up the rind to the light, we may see a thousand little specks: these specks are round sacks or bags, each of which is full of the otto or essence of the lemon or orange. If I pinch a piece of the peel near to the flame of a candle, the otto spurts out, and takes fire with brilliant flame. If I pinch the peel near to a piece of white paper, the otto spreads over it like a shower, and exhales a pleasing fragrance.

As our beer is rather acid, I bought half-an-ounce of carbonate of soda. Into every glass of beer I put as much soda as will cover a sixpence. The beer froths, and gets 'up,' like bottled

beer; the liquid acetic acid in the beer displaces from the carbonate of soda the carbonic gas it contains: hence the commotion. But lemons are acid. I put some carbonate of soda into a deep glass; I now squeeze the lemon juice over it; there is a good deal of fizzing—why? The acid of the lemon—citric acid—displaces, like the acetic acid of the beer, the carbonic gas.

I now light a spill; it burns; but turning it into the vacant space of the glass in which the carbonic and lemon acids are fighting for position, it will be noticed that the flame of the spill instantly goes out. The fact is, this little experiment shows, that though the carbonic gas displaced from the soda is invisible, it can yet be recognised by its known effects, one of which is, that it will not support combustion; that nothing will burn in it.

Mamma's smelling-bottle contains a substance, known by the name of ammonia; it is very strong. It makes one's eyes water to smell it. I take out a piece of the sponge upon which the ammonia is placed, and put it into a glass; by squeezing a few drops of lemon-juice upon it the pungent odour instantly disappears! How so? The lemon citric acid unites with the ammonia, and produces an inodorous salt, namely, citrate of ammonia.

I now tie up a teaspoonful of flour in a little bag of linen, and I knead the flour in a bag so as to wet it, and make a paste in a large tumbler of clear water. The water very soon becomes turbid; I let it stand quiet a few minutes, and a sediment is formed. This is starch. Flour contains starch. Stir it up; the starch again falls as a sediment. Starch then does not melt—does not dissolve in cold water; but we will get a little saucepan and boil it, and again pour it into the glass. Now the starch has formed a thick jelly, and no longer forms a sediment. Heat, then, has altered it. Before the starch was subject to heat, each little granule was perfect in itself, and was surrounded with a film of wax, which the cold water does not alter; but, by heat, the starch granules burst the waxy membrane, and the starch then dissolves in water.

I now take an egg, and, putting it into a glass, fill up the vessel with white vinegar. The vinegar soon acts upon the shell of the egg, and much amusement is caused by the apparent vitality of the egg: it revolves, turning round and round upon its axis, little bubbles of gas escaping all the while. In due time the chalky part of the shell is dissolved, and the egg now is only held together with a white membrane, which is quite elastic, a dent being formed by its own weight, if held up by finger and thumb. We

may now put the egg into a bottle, the mouth of which apparently would not let it through; but, by careful squeezing and coaxing, it can be put into any ordinary wide-mouthed pomatum bottle. 'What a paradox!' you will exclaim. The white vinegar, having acted upon the egg-shell, has, in fact, dissolved the carbonate of lime that was in it; and it was this chalky body which gave hardness and solidity to the egg-shell. The vinegar, therefore, now contains the lime in combination; and this may be shown palpably to the eye by the addition of a pinch of the salts of sorrel, used in a former experiment, the addition of which, to the transparent fluids, instantly produces a cloudy-white precipitate of oxalate of lime.

Some One now makes her appearance. There are a few plums for Sissy, and half a candied lemon to divide among the boys. I now clear the table, for it is a point of honour to play at Speculation on this night—otherwise, what would become of the bag of nuts?

3. *The Lampascope.*

Many of my young friends will be pleased to hear something of this simple invention, so capable of affording them amusement. It consists in the application of the principle of the magic lantern and the dissolving views to an ordinary table lamp.

To construct a lampascope, (presuming the possession of a lamp,) the ordinary globe must be removed, and in its place a cardboard box, square, round, or octagonal, as is most convenient to make, must be substituted, and into one side of this two tubes of cardboard must be inserted, after the manner of an ordinary magic lantern. Into these tubes, which slide one within the other, lenses are to be fixed, say the lens nearest to the light shall be of two inches focus, and the one in the inner tube or outer lens of three inches focus. According to the relative power of the lenses, so will be the size of the picture on the wall: thus the lenses may be of various focuses, and not exactly, unless convenient, to the measure we take as the example; which, however, will be well understood by those whose knowledge of the laws of optics may induce them to make this lampascope for the entertainment of their friends. Between the lenses and the light a place must be made for the purpose of inserting the slides of figures to be represented on the wall upon which the disc of light is thrown. These figures may be painted on glass slides by the amateur himself, or purchased ready for use. Some very beautiful views, portraits, &c., may now be had on glass, applicable to this purpose, produced by the collodion and photographic process, and at a price suitable to most pockets.

Having thus far constructed the instrument, we have only to hang up a sheet against the wall to make it white, and having put our lampascope on to the lamp a round disc from the lenses will be shown on the sheet. The tubes must be regulated like a telescope to make the picture distinct; and according to the character of these so will the exhibition be, 'grave or gay, lively or severe.'

4. *The Pepper-Box Trick.*

The tricks performed on the stage are inferior to those shown at our Christmas parties, because the public conjuror has all the advantage of trap-doors, 'properties,' and paraphernalia of the boards. He can make his 'exits,' and his 'entrances' just where it is most suitable; but the private magician has no such appliances, his tricks must be performed by hand,—this is *leger-demain* in reality. If you have ever invested a penny in oysters at a stall, or in potatoes 'smoking hot' from a can, it is probable that you have seen a pepper-box of the precise pattern adapted for this trick. The box is of no particular design, but resembles a street post, and is sold by fashionable ironmongers at the low price of 4*d.* Possessing a box of this description, get a tinman to unsolder the bottom, and then fasten on to it a tube of tin that will just fit the inside of the

box like a telescope. At the bottom side of this tube a slit must be cut that will let a shilling slip through. In the lid of the box a duplicate top is to be fastened, leaving inside a piece of tin, that will rattle when shaken. Now for the trick. Take the box in the *left* hand, ask one of the company for a shilling or a sovereign, and to mark it that it may be identified. With the *right* hand draw off the lid, and request that the money be put into the box. It will of course slip through into your left hand. Put on the lid, and push up the telescope bottom quickly, and passing the box to the right hand, rattle it, and ask where the money shall fly to. Have a cup at hand (near the left), and as a feint, say, 'Here it is!' at the same time letting the

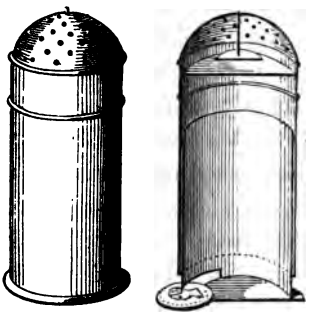


FIG. 1.

money fall into the cup. Presto! Fly! It is now again in the box, and by a rattle it appears

so. Remember all the while to hold the money fast in the cup to prevent detection. Presto! Fly again! It is now down Willy's throat—is it not so? Place the cup to his ear; out it falls. Well, I never! Is it the same shilling? To be sure it is; there's the mark! This completes the pepper-box trick; but the routine indicated for its performance can be easily varied by any adept at legerdemain. See Fig. 1.

5. *The Inverted Glass of Water.*

This little experiment affords at the same time amusement and instruction. Wipe a wine-glass perfectly dry; then pour water into it until it is full; indeed, if care be taken to have the glass quite bright, it may be filled above the brim. Now take a card, carefully place it on the top of the water, and press it on the rim of the glass. If this be cleverly done, there will be no air bubble between the card and the water; and if the glass be more than full, this can be with certainty accomplished. Now dexterously turn the glass upside down, keeping the finger on the card the while. This being done, the finger can be removed from the card, and yet the water will not run out, nor will the card fall away. The instructive part of this experiment consists in explaining why the water remains in the

glass, which is this:—The familiar gurgling sound when liquids are poured from a bottle arises from the air rushing through the liquid, and taking its place in the bottle. The air which passes into the bottle must be the same in bulk as the fluid which runs out, otherwise there will be no flow; and for the same reason we make a vent-peg hole in a cask; the law of nature demanding a pint of air for every pint of

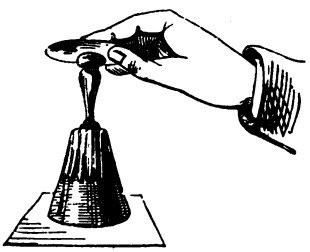
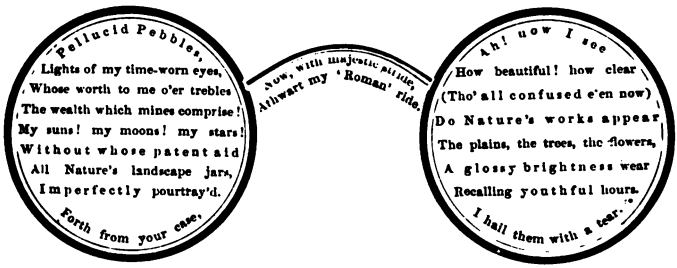


Fig. 2.

beer that is drawn. In the little experiment under illustration no air can get into the glass and as a consequence, no water can run out. If the glass, still inverted, be placed on to a tray, the card can be slipped away, and yet no water will flow out. In this way you can hand a glass of water to a friend, but he cannot remove it without spilling the whole. See Fig. 2.

6. *Grandma's Soliloquy.*


Pellucid Pebbles,
Lights of my time-worn eyes,
Whose worth to me o'er trebles
The wealth which mines comprise!
My suns! my moons! my stars!
Without whose patent aid
All Nature's landscape jars,
Imperfectly pourtray'd.
Forth from your case,
Now, with majestic pride,
Athwart my 'Roman' ride.
Ah! now I see
How beautiful! how clear
(Tho' all confused e'en now)
Do Nature's works appear
The plains, the trees, the flowers,
A glossy brightness wear
Recalling youthful hours.
I hail them with a tear.

7. *The Vital Cards.*

Every one is delighted who sees this illusion; it is a fact, that there is not a trick shown by Anderson, Houdin, Frikell, or Robin equal to it. We have before said that the legerdemain shown at private parties is generally superior to that exhibited at the theatres,—it is not so imposing with paraphernalia, but the tricks have more merit. In the drawing-room there are no trap-doors, no side-scenes to help out a deception, the apparatus must be perfect in itself, and such is an example in the trick of vital cards we are about to describe.

Having a pack of cards, we ask two persons in the company to choose one each; they do so. We now touch the back of each card with our glass divining-rod, and then tell the company the names of the picked cards. So far so good. The

whole cards are now shuffled, and put into the card-case A (Fig. 3), standing on the pedestal B. Say, 'Name your cards!' Quickly as the words are uttered, the two chosen cards rise out of the pack, and thus to demonstration prove their vitality. Supposing the nine of diamonds and the king of clubs were the cards previously drawn, these two would be the only ones that

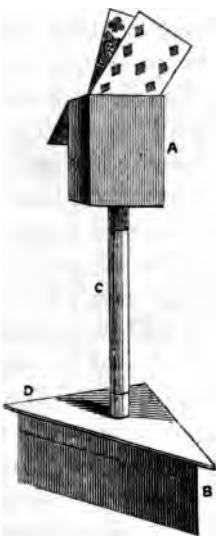


Fig. 3.

walk out of the pack, as illustrated in the wood-cut. Now for the explanation of 'how it is done.' The whole principle of this trick is based

on the gradual flow of sand through a small aperture, as is commonly shown in the hour-glass. The column C is a hollow tube, the pedestal B is a box. The whole apparatus consists of four parts: the case A, the pillar C, the base B, and the lid of it D. On this lid is a socket, on to which the tube pillar fits. At the bottom of case A is also a socket, which fits into the top of the pillar like a short tube of a telescope. Inside the lid D is a trigger, which opens and shuts a small aperture in its centre, and in connection with the pillar; the trigger is brought to act on the outside at the back of the base B, so that a conjuror can press it when required, at an instant, as he moves the apparatus from one table to another. Now, suppose we fill the tube C with fine dry sand, and the trigger is closed, of course the sand will remain there, but if the trigger is opened, the sand will flow gradually into the box. If a weight of lead be placed on the top of the sand, it will descend like a clock-weight as the sand escapes from under it. Now it will easily be understood, on reference to fig. 4, which is an enlarged view of the card-case A, that if a thread be fixed to the centre of a bar Z, now under a card and over a bar X, then as the weight W descended, it would pull up the card. This explains the trick. The height of the pillar is a trifle over twice the length of a card, and the

weight descending this distance pulls with it the length of thread necessary to raise the card to the top; if the weight be great enough, it will pull up two, three, or more cards.

In practice, this and similar tricks require peculiar packs of cards, and the following hints will be found useful.

We can purchase any quantity of cards we choose of *one suit*, at the card printers—legally, a

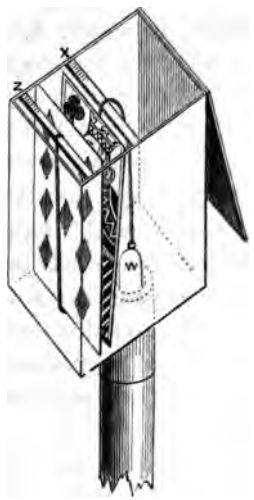


FIG. 4.

pack of cards is perfect so long as it has paid the ace of spades duty,—we may, therefore, purchase fifty-one 'nine of diamonds,' so long as we pay

for the ace of spades its proper duty; or we may have a pack of two suits, three suits, as we think fit. We can also arrive at the same ends by procuring several packs of cards and then *sorting* them; and perhaps the last thing a novice would think of is, that you should possess twenty aces of spades in one pack! but if you have twenty packs, and then sort them, all difficulty on this score vanishes. But we are digressing. When you begin the trick of Vital Cards, you must possess a pack of two suits, bottomed with an odd one. Cut the cards; offer one half to the company to choose one. With your divining-rod, it is evidently certain that you can tell what card they have. Repeat the same for another. The chosen cards being known, request that they be put again in the pack, 'anywhere,' 'top,' 'bottom,' or 'centre.' Now put the pack into the case A, exclaiming, 'Name your cards and they shall walk out!' The nine of diamonds and the king of clubs. Presto! out they march.

Before you exhibit this excellent illusion, you 'wind up the apparatus' by first closing the trigger in the lid (Fig. 5 represents the inside of the lid and sliding trigger) over the aperture in connexion with the pillar, then fill the tube or pillar with fine sifted sand; now put on the cardcaps, and finally two duplicate cards of those you intend to be 'vital,' on the weighted thread, in

between the bars z and x; let the weight rest on the sand. When the cards are to rise, you have only to slide the trigger as you move the apparatus from your table 'to a position that all may

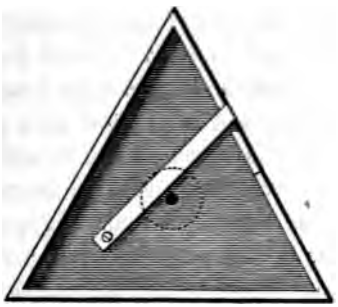


Fig. 5.

see.' The sand falls gradually, and with it the weight. Innocently the cards rise amid clapping of hands and huzzas, 'Do it again!' 'Encore!'—but which can readily be made to subside by handing round wine and cake. When you have private reasons to object to an encore in conjuring, as in singing, or playing an air (and, between you and me, we all know pretty well when this will happen), be particular to make the waiter arrive with coffee and ices; the 'encores' will then turn upon them and relieve you.

8. *Electrical Experiment.*

Take 100 common iron beads, and string them on a copper wire (wound with silk thread) in such a manner that they do not touch each other, say the thirty-second part of an inch apart; hang the wire thus formed in a convenient position, and you will find that the moment you touch the ends of the wire with the conductors of a galvanic or electric battery, the whole beads will contract; separate the wire from the conductors, and they will fall to their first position. This experiment will be found both amusing and instructive to repeat often. Here we have a specimen of animal electro-magnetism, only that the animal has, instead of our one string and 100 beads, many hundreds of strings (fibres) and millions of beads (globules), and that instead of the globules being strung on a wire, they are incased in hollow tubes (fibres), and connected with spinal flexible electric conductors (nerves).

In this wonderful experiment the copper wire is wound round with silk thread, in order to insulate the iron beads from electric contact with the copper. The *rationale* of the experiment is this:—When iron is placed *in situ* at right angles to a stream of electricity, the iron becomes magnetic; in the above case, each bead assumes for the instant the properties of a magnet, and hence they attract each other. The common

'steel beads,' when not of too good quality, will answer for this very well; if, however, the steel is of very good quality, each bead remains for some time permanently magnetised.

9. *The Rainbow Fire-Cloud.*

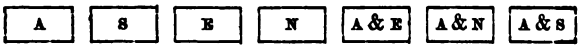
To perform this interesting experiment it is necessary to have a strong thick globe of brass or iron, capable of holding about half a pint of liquid. About two inches apart are made two apertures in the globe; into one is fixed a small fountain jet with a tap to turn at will; the other aperture is used for putting certain liquids into the interior, and when not in use must be screwed up perfectly tight. Thus constructed, the apparatus represents a model steam-boiler—the manhole to put the water in, the jet to blow the steam off when the water boils. Now for the cloud. When spirit of wine is burned in contact with certain substances, the flame is coloured green, red, yellow, blue, according to the material used. For the rainbow cloud we take four ounces of spirit, one drachm each of nitrate of copper, nitrate of strontian, nitrate of baryta, and chloride of copper. These salts will colour the flame in the above order. Having well mixed the chemicals with the spirit, it is put into the boiler, and the entrance screwed up perfectly vapour-proof. The boiler is now set upon a

retort stand, and a spirit-lamp placed underneath it. By means of the jet-tap it is easy to discover when the spirit boils; as soon as this takes place the steam is shut off, and the heat continued for five or six minutes. The jet-tap being now turned on, the whole of the spirit blows out of the boiler with considerable force, and assumes the shape of a cloud, which is formed as the spirit condenses in the air; much in the same way as steam does, as it puffs from the 'iron horse.' Need it be said that the cloud of spirit is combustible, and that, when ignited, it becomes a fairy rainbow fire-cloud? This experiment is adapted for a chemical lecture-room only.

10. '*Willing Workmen*': *A New and Capital Game.*

Simple as this game may appear to be to those of 'riper years,' to our little 'willing workmen' it will prove a source of fun and enjoyment. It is played as follows:—One of the party—perhaps 'a fond parent' or 'a sister dear'—is 'Foreman;' and having engaged from four to a dozen or more 'willing workmen,' seats them at the work-table. Of course all are expected to work. So one must 'point a pencil,' another 'write,' another 'mend a pen,' another 'thread a needle,' another 'make spills,' or in fact undertake such employment as is suited to the capacity or talent of each. All

being 'engaged,' the 'Foreman' gives to each a card, on which is inscribed one of the following marks:—



The letters on the cards, which may be extended, where a number of cards are required, by transposing the letters about, indicate the several workmen's names. Thus, A is Anybody; S, is Somebody; E, is Everybody; N, is Nobody; A & E, is Anybody and Everybody; and A & N, is Anybody and Nobody. The Foreman has now to provide every workman with a dozen or more nuts or counters of like value.

Those that work when they are not ordered to do so will have to pay a forfeit of one nut; and those that do not work when they are told to do so, will also have to pay a similar forfeit, which forfeits are finally to be paid among all the attentive and good workmen.

'When I give orders,' says the Foreman, 'those I name must attend and work; and those not named must remain idle.' He then says, 'Everybody work!' upon which it is more than probable that every one of the 'willing workmen' will begin to work. He then immediately fines Anybody, Somebody, Nobody, Anybody and Everybody, Anybody and Nobody, and Anybody and Somebody, for 'working without orders.' He

next says 'Anybody work!' and several will again be fined for working when they ought to be idle. 'Somebody work!' Not knowing exactly whether they should work or not, several will, as well as Somebody, do so, and forfeit a nut each. 'Come, come,' says the Foreman, 'as this is holiday time, Nobody work,' and if N. or Nobody does not work, he will be fined accordingly. About the time that the fifth or sixth 'order' is given the workmen will begin to remember their names, and so avoid having forfeits to pay. Then the cards are to be shifted round so that each 'willing workman' receives a new name, and Anybody may become Somebody; and Nobody, Anybody, &c. Finally, when the game is 'stached,' the Foreman pays from the forfeit-bag twelve or six nuts, as agreed, for every one nut there may be held by each 'willing workman.'

11. *What did you Wish?*

By a very simple *ruse* a few friends can be well entertained for a short time by the 'Master of the Ceremonies' (apparently without any previous knowledge) telling them what they wished for. What did I wish for? Perhaps a flower? —No. A puzzle?—No. A piece of music?—No. A library?—No. A work-box?—No. A dog?—No. A volume of 'Chymical Magic'? —Yes. 'How could you tell that?' is the natural

question that follows; and the answer is this: Before you are going to tell what a friend wishes for, you must previously concert with one of the company to give you a key to unlock the mystery, which is done in this way:—while you are out of the room, your confederate hears, or, if active, will manage to suggest, the thing to be wished for, and you have an understanding with him that before the article wished for is named, he is to ask you if it was a chair, or a horse, or a cat, &c.; in fact, anything with *four legs*. After that, the article named is the thing wished for. Thus he asks you was it a flower, puzzle, library, work-box, *dog*? To all of which you answer 'No;' but after *dog*, which has four legs, he says, 'Volume of "Chymical Magic"?' and you of course reply, 'Yes.' As this little trick can be varied with any number of persons, and any variety of articles, it affords good entertainment for evening parties.

12. *The Mysterious Lamp.*

At a distance from the earth which it is utterly impossible to convey any idea of, there is another globe; and if the optical and astronomical calculations be correct, the sun which lights and warms that globe (for it has a particular sun of its own) gives days of different colours. There are green days, red days, blue days, yellow days, corresponding to Sir Isaac Newton's seven prismatic

colours. Now, all objects visible on these several days will of course vary according to the particular colour. The yellow day, from our experience of this colour, must be the most dreary and miserable; for though yellow is all very well in its way, mixed up with other colours, helping, like a thunder cloud, to enhance the beauty of the distant sky, yet, when everything is yellow, then we discover its peculiar effect on our visual organs. A simple and inexpensive experiment, and one that is often shown at the Colosseum and Polytechnic Institutions, illustrates the effect of a yellow day. Spirits of wine poured on a teaspoonful of common salt in a vial, well shaken, and then put either on to lamp-cotton or tow, and ignited, will burn with a peculiar coloured flame, giving out purely yellow rays. This mysterious effect changes the appearance of all earthly objects. Coral lips become of a livid hue; rosy cheeks turn ghastly pale; red cap ribbons become black; in fact, everything appears different to what it does by the white light that we are familiar with; and of all things the human face undergoes the greatest change. Very young children should not be shown this experiment; for though there will be laughing lips and dazzling eyes, yet they are of such an unearthly colour, that old friends appear with new faces, and a child would scarcely know its own mamma.

13. *Amusement.*

With the aid of a bundle of splints and half a pint of gray peas that have been softened in water, any person may not only amuse himself, but afford considerable instruction to a family circle. With these little sticks and peas all kinds of geometrical figures, architectural illustrations, &c., may be formed. The wood splints, such as are used at the tobacconists', are to be split into about three pieces; each stick is then to be pointed, so that it will easily enter a soft pea. Without exactly describing where to begin, it will readily be perceived that with three peas and three sticks we can form a triangle; with four peas and four sticks a square is made with equal facility. When these simple figures are formed, we may begin solid patterns, such as a cube, which will require twelve sticks and eight peas. From a cube we can pass on to other forms, and thence to the outline of a cottage, till at length, with a little practice, almost any designs may be illustrated in a skeleton form. The invention of this little toy, if such it may be termed, is due to one Frederick Fröbel, a German, well known as the founder of the Kinder-Gärten, or (to speak in old English) infant gardens. Fröbel not only trains his children with little sticks and gray peas, but he also employs square blocks of wood, coloured balls, and such things, all for the purpose *of teaching, b*lended with amusement.

14. *Conjuring a Ring.*

Several very marvellous tricks can be shown with an ordinary finger ring, such as passing it through the table, through a basin, an ale-glass, or a plate, then into a box or nest of boxes, and other feats of legerdemain of a similar kind. These tricks are so good that they are always shown by the professors of magic at evening parties, but are never explained: however, we will attempt it. Procure a soft clean silk handkerchief and a sham gold ring; now a needleful of black silk, double; sew the silk to the middle of the handkerchief, and let the ring hang from it, suspended by the end of the silk, say at about three or four inches from the kerchief. When the handkerchief is held up by two corners the suspended ring must always hang on the side facing the magician; the handkerchief can then be shaken, folded, and crumpled up in the hands so as to make it appear 'all fair.' Now, to pass a ring through a drinking-glass and plate, and through the table on which it is placed. 'If any lady or gentleman will kindly lend me a ring, I shall be happy to exhibit the electric and magnetic action of metallic substances on diaphanous bodies and ceramic manufactures, by showing their imperviousness, and the porosity of ligneous products of the Honduras.'—'Hem!' says Aunt Caroline, '*what an extra*ordinary youth!' Do not, how-

ever, allow yourself to be carried away by any flattery of this kind, but determine to do the trick well, and *deserve* praise. Take the borrowed ring in the *left* hand, and keep it there; pretend to pass it to the *right* hand, and say, 'I will place it in the handkerchief. Who will kindly hold it for me while I put the glass on the plate in the centre of the table?' While you thus freely ask who will hold the kerchief, you will secure the most bashful lady or gentleman in the company to hold the (your) ring in the handkerchief. 'You will perceive, ladies and gentlemen, that the glass and the plate are now quite empty. I shall now place the glass in the plate on to the centre of the table, and request the lady (or gent) to place the ring and the handkerchief over the glass. I particularly draw your attention to the fact that you will *hear* the ring fall into the glass when I request it to be released. You will then be certain that it is in the glass; but at my command it shall pass into this box (show the box round), which I shall place under the table. Now, miss (or sir), be good enough to let the ring fall into the glass. Silence! Ting! You heard it fall?'—'Yes!' all must reply, except the deaf. Presto! It is now in the box. You lift the handkerchief, smooth down your brow with it, and put it into your pocket. The audience are now left to themselves. They rush to the plate and glass—it is not there: now the box, behold! it is

as sound as ever—how it got there Aunt Carry could never tell, but you could, for you put it there out of your *left* hand when you placed the box under the table. If you employ a little square tin box which will be found convenient to have made for this trick, place it with its hinge-lid open on a side-table behind you; when you fetch the box it is easy to put the ring in and shut the lid.

15. *A Colour that appears and disappears by the Influence of the Air.*

File up a piece of copper of about the size of a farthing; the filings thus obtained put into a well stoppered bottle; now pour on the filings one or two ounces of liquid ammonia, or strong hartshorn; a beautiful blue colour will quickly be produced. If the bottle be now stoppered the colour will presently disappear; but when it is unstoppered the air gains admission, and the colour soon reappears in its cerulean beauty. This simple experiment may be repeated several times.

16. *Leisure.*

How happy all ought to be who have leisure, a freedom from business or hurry, a convenience of time to do just what the mind dictates—to read, to walk, to ride, to study, or to play. I hope you who *have leisure* have a consideration for those who *have it not.* Many a weary limb will rest to-night

but to labour again on the morrow, on and on, day after day, from sunrise till far into the coming night. To such leisure is unknown. They may be likened unto the Apostles, 'coming and going, and they had no leisure so much as to eat.' You who have leisure, be proud of it, make use of it; once past, it is sunk into the catacomb of eternity. Leisure is spare time; and, properly employed, it is so much of life increased beyond its natural span.

Make time in time, while yet time last;
For time is no time, when time's past.

17. *A Solid produced from Two Liquids.*

Make a saturated solution of chloride of calcium, and another saturated solution of silicate of soda. Both these liquids are quite bright, and nearly as colourless as water. By mixing these fluids in equal proportions in a glass, a solid substance will be produced.

18. *Magic Fountain Ring.*

This is very amusing: the secret is simple. The ring being made hollow, on the under side it

Fig. 6.

has a nipple which is attached to an elastic ball; this being filled with perfume, a little pressure of *the hand causes a jet.*

19. *A Sweet Philosophical Experiment.*

If we stand in front of a mirror when it is dark and crush sugar-candy between the teeth, the mouth will be seen full of electric light.

20. *To Reveal a Person's Thoughts: an excellent Card Trick.*

From a pack of cards, previously shuffled and cut, deal out (with the face upwards) twenty cards in ten separate couples, and request each person in company to select one couple, and remember the two cards selected, so as to state their after position.

The dealer having collected the cards together promiscuously, but in couples, he then places them in four rows, with five cards in each row.

The order in which he places the cards in each row indicates with certainty the couple selected by each person.

To enable him to do this he has recourse to a mental table of four words, each word consisting of five letters, making twenty in all, so that each letter represents a card, as shown below.

The first card he puts on M in MUTUS, and the next on M in NOMEN; that is to say, on the first and thirteenth places of his intended square of twenty places. Having disposed of the first pair he proceeds to put the next card on *v in* the second place of the first line, and on its

companion in the fourth place of the same line. The next card is placed on the spot occupied by T in the first line, and on T (or tenth place) in the second line. The first card of the fifth couple is placed on S in the first line, and on S in the fourth line. Having completed the first line, he proceeds with the word DEDIT in the second line, then with NOMEN, and finally with COCIS, filling up the remaining vacancies by placing each couple of cards on corresponding pairs of letters, until the square is complete, as shown it the third table.

He now asks each person where the cards he selected in his mind are now situated. If he says that they are both in first line, then he thought of the cards occupying the places of the two U's.

If he says that one card is in the first, and the other in the third line, then he thought of the cards occupying the places of the two M's;

If in the first and second lines, of the two T's;

If in the first and fourth lines, of the two S's;

And so on with each pair of letters corresponding with the couple of cards selected.

A little practice is required to strengthen the memory, so as to pair the letters as they present themselves in the words which represent the places of twenty cards. It should be noticed that, although there are twenty places, there are only ten different letters, or ten pairs.

This is a clever feat of mental ability, and very much surprises those who are unacquainted with the method of doing it.

THE KEY.

M	U	T	U	S
D	E	D	I	T
N	O	M	E	N
C	O	C	I	S

In the following Table the Places of the Letters are numbered in rotation:—

1	2	3	4	5
M	U	T	U	S
6	7	8	9	10
D	E	D	I	T
11	12	13	14	15
N	O	M	E	N
16	17	18	19	20
C	O	C	I	S

The figures in the following Table show the order of laying down the Cards:—

1	3	5	4	7
M	U	T	U	S
9	11	10	13	6
D	E	D	I	T
15	17	2	12	16
N	O	M	E	N
19	18	20	14	8
C	O	C	I	S

21. *The Revolving Siphon.*

Take a tall narrow round vessel, A, and fit two pieces of wood, *a a*, across the inside. Bore

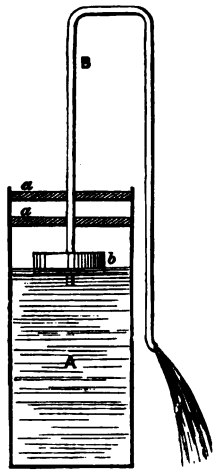


FIG. 7.

holes through the pieces, so that they will be in the centre of the vessel, and one above the other. Bend a small glass tube into a siphon, B, keeping the legs straight, with two right angles at the top. Next turn the end of the longest outward, so that the bent part will correspond with the line of a circle, the shortest leg being the centre. When the siphon is properly placed, the bent end is horizontal. Put the short leg loosely down through the holes in the pieces, after which push it tightly half an inch through a cork, b, large

enough to float and sustain the syphon. The long leg will now be on the outside of the vessel. Pour clean water into the vessel until the cork nearly touches the cross piece. Charge the siphon by suction, and it will commence revolving rapidly around the vessel so soon as the water flows.

22. *The Expunged Figure discovered.*

In the first place desire a person to write down secretly, in a line, any number of figures he may choose, and add them together as units; having done this, tell him to subtract that sum from the line of figures originally set down; then desire him to strike out any figure he pleases, and add the remaining figures in the line together as units (as in the first instance), and inform you of the result, when you will tell him the figure he has struck out.

Suppose, for example, the figures put down are 76542; these, added together as units, make a total of 24; deduct 24 from the first line, and 76518 will remain; if 5, the centre figure, be struck out, the total will be 22; if 8, the first figure, be struck out, 19 will be the total.

76542 = 24
24

76518

In order to ascertain which figure has been struck out, you make a mental sum one multiple of 9 higher than the total given. If 22 be given as the total, then 3 times 9 are 27, and 22 from 27 shows that 5 was struck out. If 19 be given, that sum deducted from 27 shows 8.

Should the total be equal multiples of 9, as 18, 27, 36, then 9 has been expunged.

With very little practice any person may perform this with rapidity; it is therefore needless to give any further examples.

23. *A Brown Paper Magnet.*

A very simple and interesting magnetical experiment may be made with a sheet of brown paper, illustrating, in a remarkable manner, how the most astonishing effects may be produced by the simplest means.—Take a sheet of coarse brown paper, and after holding it before the fire till it is perfectly dry, fold it up into a long strip of about two inches wide: the magnet is now complete. To exhibit its attractive power cut some strips of writing paper about three inches long, and as wide as the space between these lines; place them upon the table three or four together. Now take the magnet, and draw it briskly under the arm two or three times; its electro-magnetism is instantly developed, and becomes apparent when held over the small strips

of writing paper, for they fly up from the table towards the paper magnet veritably 'by the wings of lightning.'

24. *Photo-Sculpture.*

An ingenious application of photography has been recently made in Paris by M. Théophile Gautier of 42 Boulevard de l'Etoile, to which the name of PHOTO-SCULPTURE has been given.

By this process busts and statues of living persons are prepared in plaster and 'biscuit' which possess much of that faithfulness and minute accuracy of detail which are so striking in photographic portraits. The principle of the new art is easily explained. The person whose bust or statue is to be taken is placed in the centre of a circular apartment 40ft. in diameter, and 24 cameræ obscuræ are placed along the wall at equal distances from him and from each other. By means of a latch, which raises and drops the slides at any moment, twenty-four photographs are taken at the same instant of the sitter.

He is thus represented from 24 points of view. There are, of course, six front views, six back views, and twelve side views, so that a clever artist would find in these photographs all the materials for a piece of sculpture to be fashioned by the eye. But this is *not the course* taken, mechanical processes being

adopted which ensure much greater accuracy. The negative of one of the portraits is placed in a

FIG. 8.

magic lantern, and the image printed upon it is projected on a large sheet of rough glass. The block of clay in which the model is to be cut is then placed on a revolving stand, the circumference of which is divided into twenty-four parts.

A pantograph is next employed, by which the clay is cut exactly to represent the outline on the glass. When one photograph has been copied, the image of the next is placed in the lantern, and the clay *is turned* round $\frac{1}{24}$ part of a circle.

It is then copied, and so on with the twenty-four negatives. The result is that the block of clay

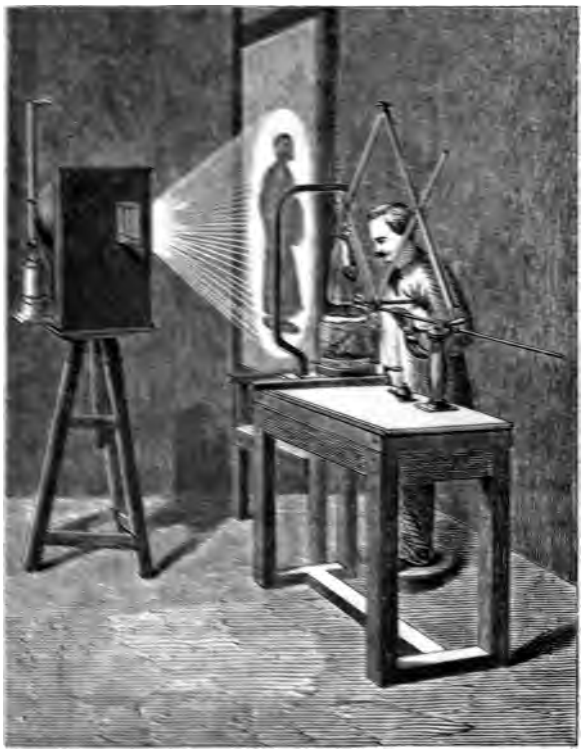


FIG. 9.

exhibits twenty-four sides, or facets, representing exactly the outlines of the twenty-four photographs. Of course there are ridges left which

must be smoothed down. Sufficient, however, has been said to show that effects are produced by the new art altogether different in kind from those arrived at by the methods of the sculptors, and that, in short, the figures prepared by this process possess some of the best qualities of photographs.

25. *A Liquid converted into a Solid.*

Dissolve about half a pound of Glauber salts (sulphate of soda) in a pint of boiling hot water; allow it to stand for a minute, so that any impurities may subside; then pour off the clear liquor (boiling hot) into a glass vessel. Now put a few drops of sweet oil on the surface of the solution, and place it where it can get cold, and remain undisturbed. When cold, it will appear as clear and liquid as the same quantity of water; if, however, a stick, or any solid substance, be put into it, so as to form a nucleus, it will instantly become opaque, and change into a solid mass of crystals. The oil is used to prevent dust or extraneous matter from touching the surface of the solution, which would cause it to crystallise without an apparent reason.

26. *Singular Arithmetical Fact.*

Any number of figures you wish to multiply by 5 will give the *same* result if divided by 2—a

much quicker operation; but you must remember to annex a cipher to the answer when there is no remainder, and when there is a remainder, whatever it may be, annex 5 to the answer. Multiply 464 by 5, and the answer will be 2320; divide the same number by 2, and you have 232; and as there is no remainder, you add a cipher. Now take 357, and multiply by 5, the answer is 1785. On dividing this by 2 there is 178 and a remainder; you therefore place a 5 at the end of the line, and the result is again 1785.

27. *Strength of the Human Frame.*

One of the most remarkable and inexplicable experiments relative to the strength of the human frame is that in which a heavy man is raised with the greatest facility when he is lifted up the instant that his own lungs and those of the persons who raise him are inflated with air. The heaviest person in the party lies down upon two chairs, his legs being supported by the one, and his back by the other. Four persons, one at each leg and one at each shoulder, then try to raise him, and find his dead weight to be very great, from the difficulty they experience in supporting him. When he is replaced in the chair, each of the four persons takes hold of his body as before; and the person to be lifted gives *two signals,* by clapping his hands. At the first

signal, he himself and his four lifters begin to draw a long full breath; and when the inhalation is completed, or the lungs filled, the second signal is given for raising the person from the chair. To his own surprise, and that of his bearers, he rises with the greatest facility, as if he were no heavier than a feather. Sometimes, when one of the bearers performs his part ill, by making the inhaling out of time, the part of the body which he tries to raise is left behind. The experiment was performed at Venice, by sustaining the heaviest man of the party on the points of the forefingers of six persons. It is asserted, that the experiment will not succeed if the person to be lifted is placed upon a board, and the strength of the individuals applied to the board. *Abridged from* SIR D. BREWSTER'S 'Natural Magic.'

28. *The Watch Trick: If a person will tell you the hour he means to dine, you can tell him the hour he intends to get up that morning.*

First ask a person to *think* of the hour he intends rising on the following morning; when he has done so, bid him place his finger on any hour he pleases on the dial he would wish to dine, and to remember the hour he first thought of. To the hour his finger is on you now mentally add 12, and request him to retrograde, counting the number of hours *you* mention, whatever that may

be, but that he is to commence counting *with* the hour he thought of *from* the hour he points at: for example. Suppose he thought of rising at 8, and places his finger on 12 as the hour of dinner, you desire him to count backwards 24 hours, 12 he calls 8 (that being the hour he thought of rising), 11 he calls 9, 10 he calls 10, and so on (mentally but not aloud) until he has counted 24, at which point he will stop, which will be at 8, and he will express his surprise to find that it is the hour he thought of rising.

29. *The young Chemist's Chameleon Mineral.*

Scheele, the celebrated Swedish chemist, is the inventor of this composition. To prepare it, take one part of deutoxide of manganese and three parts of nitrate of potassa (nitre), reduce these substances to a very fine powder, mix them, and place them in a small crucible. Keep them at a red heat in a common fire for twenty minutes, then let them cool. Place four grains of this substance in each of two glasses; pour cold water into one, and the liquid will become first green, then in a few moments purple, then red; fill the second with moderately hot water, and you will obtain a beautiful violet which changes into crimson. The colours will be of greater or lesser intensity in proportion to the quantity of the powder used; thus, 11 grains in a pint of water will produce a

rich green, which passes to a deep purple and a red. In a considerably larger quantity of water the purple gives place to a rose colour. In the course of these changes of colours, the various intermediate shades will be observed; thus the green passes successively to blue, violet, blue-violet, red-violet, purple, and pure red. These variations in colour are due to the several degrees of oxidisation of the manganese. It may be remarked, it will be more rapid with an excess of manganese, and slower with an excess of nitre.

30. *Square Words.*

The squaring of words is an entertaining task, rather more amusing than constructing acrostics. The writer of the following, which appeared in 'Notes and Queries,' says that four letters are easy, that five letters are respectable, six letters difficult, seven letters a triumph.

Q U E E N	C R I M E A	L E A V E
U S A G E	R E M A N D	E L L E N
E A S E S	I M A G E D	A L O N E
E G E S T	M A G P I E	V E N O M
N E S T S	E N E I D S	E N E M Y
	A D D E S T	

31. *To Tell any Number Thought of.*

Ask a person to think of a number; then tell him to subtract 1 from that number; now tell

him to multiply the remainder by 2; then request him again to subtract 1, add to the remainder the number he first thought of, and inform you of the total. When he has done this, you must mentally add 3 to that total, and then divide it by 3, and the quotient will be the number first thought of.—This is an excellent arithmetical pastime, examples of which are below.

10	15	18	23
1	1	1	1
9	14	17	22
2	2	2	2
18	28	34	44
1	1	1	1
17	27	33	43
10	15	18	23
27	42	51	66
3	3	3	3
3)30	3)45	3)54	3)69
10	15	18	23

32. *The Cannon-Ball Trick.*

As cannon-balls are now in fashion, and as one of the most astonishing illusions which M. Houdin used to exhibit was that of bringing a 'thirty-two pounder' into a gentleman's hat in the 'most mysterious manner,' an explanation of the trick may perhaps be acceptable to juvenile conjurors. The illusionist borrows from the audience two hats, which he places upon his table,

d by way of diversion gives a brief lecture ıon head-dresses in general and hats in particu-:. 'Show me his hat,' says the professor, nd I will describe the man. Here's your "flat im;" that's a "fast man." Here's your "broad im;" that's a man of peace. Here's your "un-ushed either-way-front" hat; that's an untidy chelor. Here's your "well-worn" but still lecent" hat; that's a family man. A Gibus! at's a play-goer.' And thus he proceeds. Now king the borrowed hats from the table he ad-nces to the company, when, lo! on turning em over, out fall the cannon-balls, rolling on e floor with a noise of thunder! The secret is is:—Any workman using a lathe can turn a ll of wood of a size big enough to go into a t. When such is procured, a hole, about two ches deep, and of the size of a finger, is made it. The ball is then to be painted and black-ıded and made to appear as much like the real

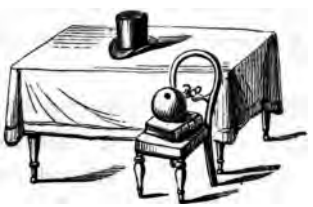


Fig. 10.

ing as possible. By the simple contrivance of e hole, the balls can be lifted up in the same

way and with as much ease as a thimble. At the side of the table that is farthest from the audience place the balls, raised on a chair and a few books, to nearly the level of the table. When the hats are taken up there will be no difficulty whatever in putting the balls into them unperceived, because as you draw the hats over the side of the table you can put on the 'thimble;' then by bending the finger the ball is in the hat. A modification of the above can be done with a large white-heart cabbage: the loose leaves are picked off, and it is made 'ready for the pot.' The stalk is then scooped out for the fore-finger to go in; it can then be played with in the same way as the cannon-ball. See Fig. 9.

33. *Artificial Sun-Light.*

The metal magnesium is now being regularly manufactured, and has become an article of commerce. It can be purchased at most of the operative chemists who sell articles for philosophical experiments.

This metal possesses many curious properties. It is not ductile enough to be *drawn* into wire like several other metals; nevertheless, wire of magnesium is made by *pushing*, that is by forcing it through a small hole in a hot steel plate.

Magnesium in the form of wire will ignite and burn very readily when placed in the flame of an

ordinary candle or lamp. When magnesium burns, the light evolved is so great, so intense, that it can only be compared to that of the sun, and photographs can be taken by it. The spectroscope shows that the sun contains magnesium!

34. *Who wears the Ring?*

A very interesting entertainment for an evening party of 'young people,' illustrating the use of figures and the three first principles of arithmetic, may be shown to a circle of friends by any young gentleman or lady who will learn the following simple rule. We should premise that the problems to be solved are these:—Who wears a certain ring? On what finger is it? Which joint of that finger does it encircle? All that are 'in the game' are to be seated in a row, and each individual is to pass by the name of a number; beginning at the top with *one, two, three,* and so on. The person who is to tell where the ring is must now leave the company, and on his return to the cry of 'Ready,' a number is given to him, say 982; and from it he is to calculate the exact position of the ring. The number given must be found thus:—Suppose the number of the person who has the ring is 7; double it; that will be 14; add 5; it will then be 19; multiply this by 5, and you will have 95; to this add the number of the finger that the ring

is on, say the third; 95 and 3 is 98. To these figures put the last figure, or number of the joint the ring is round, say the second joint; 98 and the figure 2 put in front will make the sum equal to 982. You must now make the call 'Ready!' and when the 'clever man' appears, the supposed number 982 is given to him as the position of the ring. Its exact place he finds by being 'in the secret,' that from whatever number thus obtained he is to substract 250. Now this number being taken from 982 leaves 732, indicative of the ring's position, viz., on No. 7, 3rd finger, 2nd joint.

35. *Houdin's Nut Trick.*

To perform a clever trick with dexterity before a 'small party' is at once to become the hero of the evening. If you cannot sing, you must solve conundrums or dance a hornpipe; if neither of these be 'your forte,' a good trick or two will give equal pleasure to the 'bright blue eyes' peering at you. The nut trick is exhibited thus: The professor hands the audience a dessert plate and a cambric handkerchief for examination; these being returned, he places the plate upon a table near to him; the handkerchief is then spread out quite flat over the plate. At command, sugared almonds, nuts, and comfits pour into the dessert plate the instant the kerchief is lifted up, *producing* an effect that would have astonished

the magi of old. The way in which it is done is this:—Make a calico bag large enough to hold the nuts and sweetmeats you intend to distribute, exactly to the pattern of a nightcap, or the letter

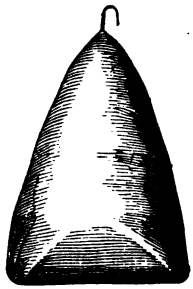


Fig. 11.

A: a small selvage is turned up at the bottom of the bag; procure two pieces of watch spring and bend them quite flat, each spring to be exactly half the diameter of the bag. These are put into the selvage, and sewn up firm. When the bag is opened, it will close itself in consequence of the springs. A long pin is passed through the top of the bag, and bent round hook-shape. If the bag be now filled with nuts, &c., it may be suspended by the hook, without any danger of the nuts or anything else falling out; because, although the mouth of the bag is downwards, the springs keep it shut. When this trick is to be shown, the prepared bag is hung on the side of the table that is away from the audience. The

plate is also placed on that side; and when the handkerchief is laid over the plate a portion is left to fall over the side of the table. Now the kerchief is picked up with the *right* hand in the centre (just as a lady does when she wishes to exhibit the lace edge), and with it the bag of nuts; the folds of the cambric hide the bag. The left hand is now used to draw over the handkerchief and to press the bag; this causes the springs to open, and out fall the 'good things' upon the plate. This creates sufficient diversion for the merest tyro of a conjuror to drop the bag behind the table unseen, while he advances to the audience politely inquiring, 'Will you take a few nuts or sweetmeats?' See Fig. 10.

36. *Golden Ink.*

It is a very 'interesting' amusement to write one's 'own verses' in the album of a 'friend;' but when it is done in golden ink, and with a pen prettily entwined with beads—the gift, perhaps, of the fair owner of the album—then it ceases to be 'amusement,' it is 'real' poetry—it is our golden age. Now the golden ink is made thus:—Procure a shell of gold, and with a camel's hair pencil wash off the gold from the shell with thin gum water, and put it into a very *small phial*, such as is used for permanent ink for

linen; when used, it needs only to be well shaken before the pen is dipped in; after writing, the gum causes the gold to adhere to the paper. Where there is any flourishing, or ornamental writing, parts of it may be brightened by burnishing; that is, rubbing the lines with a polished piece of smooth steel, a piece of agate, or the smooth side of a sheep's or ox's tooth.

37. *Inexplicable Motion and Sound.*

Procure a piece of lead pipe, about two inches in the bore and three inches long; the thicker the lead is, the better for the experiment. The pipe being set up on end, we will call it the stand. Next obtain a piece of brass, about eight

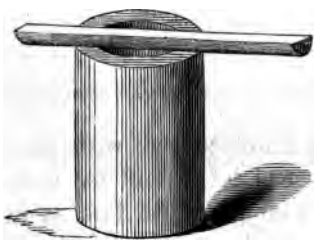


FIG. 12.

inches long, one inch to one-inch-and-a-half wide, and a quarter of an inch thick; file away the edges of one of the flat sides to make it oval-shape, so that it will rock to and fro, if it be put in

motion upon a table. Instead of having the brass filed, a blacksmith can give it a slight curve (observe, it must be lengthways) by a few blows with a sledge hammer; either way answers the purpose, and, when made, it is called the Hummer. The dimensions here given are not essential to the success of the experiment; they are merely given as a guide. Now, if one end of the Hummer be made hot (not quite red-hot), in a clear fire, and then laid across the stand, oval side downwards, giving it a slight rock to commence with, it will continue in motion, producing at the same time a peculiar humming sound, which motion and sound will continue for a very long time; in fact, until the stand and hummer are of the same temperature. The explanation of these phenomena must be solved by a genius as yet unknown.

38. *Amusing Experiment.*

Half fill a Florence flask with water; place it over a lamp, and let it boil for a few minutes; then cork the mouth of the flask as expeditiously as possible, and tie a slip of moist bladder over the cork, to exclude the air. The water being now removed from the lamp, the ebullition will cease; but may be renewed by pouring cold water gradually upon the upper part of the flask: *but if hot water* be applied, the boiling ceases.

In this manner the ebullition may be renewed, and again made to cease alternately, by the mere application of hot and cold water. The theory is this: water boils at 212 degrees, under the common pressure of atmosphere. Now, if the atmosphere, or a part of it, were removed, the pressure on the surface would be less; and the consequence would be, that water would boil at a much lower temperature; and this leads me to an explanation of what takes place in the foregoing experiment. I fill a flask half-full of water, and boil it a few minutes over the lamp; the steam which rises forces out the atmospheric air, and occupies its place. I then remove the lamp, and secure the flask, so as to prevent the readmission of atmospheric air. If cold water be poured over that part of the flask occupied by the steam, the cold water will condense it, and thus a vacuum will be formed. The water then, having no pressure of atmospheric air or steam, commences boiling afresh; but if hot water be poured upon it, the steam again occupies the surface, and the boiling ceases.

39. *A Mariner's Compass made on a Lady's Thimble.*

A magnetic needle, very desirable to ascertain the *presence of* iron, is easily made, of the

requisite delicacy where a magnet is accessible. A bit of thin steel wire, or a long fine stocking needle, having a quarter of an inch cut off at the point, is to be heated in the middle, that it may be slightly bent there; then while hot a bit of sealing wax is to be attached to the centre, and

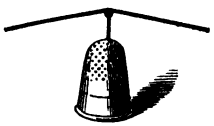


Fig. 13.

the point which was cut off, being heated at the thick end, is to be fixed in the sealing-wax, so that the sharp end may serve as a pivot, descending about $\frac{1}{8}$ in. below the centre, taking care that the ends of the needle fall enough below the pivot to keep it from overturning. It must now be magnetised, by sliding one end of a magnet, half-a-dozen or more times, from the centre to one end of the needle; and the other end, a similar number of times, from the centre of the needle to its other end. A small brass thimble (not capped with iron) will do for the support, the point of the pivot being placed in one of the indentations, near the centre of the top, when, if well balanced, it will turn until it settles north and south. If one side preponderate, it must be nipped until the balance be restored.

40. *An Arithmetical Trick with Cards.*

Take a pack of cards, place the first card on the table, with the *back* to you: look at it; if it is a seven, put 5 more cards on the top, making 12 in number: if it is a king, knave, or queen, place 2 cards on the top as before; if an ace, 11, and so on, till the pack is laid out (always making 12 in number). If any cards remain that will not make 12, lay them *separate* from the rest. Now, supposing you have 6 heaps, and 3 odd cards, strike off 4 heaps, and multiply the remaining 2 heaps by 13, adding in the 3 odd cards, which would make 29; then turn up all the heaps face to you, count the pips, and there will be 29! (taking no notice of the odd cards after you have added them in). If there are 10 heaps, and no odd cards, or 12 heaps, and two odd cards, *always* cut off 4 heaps; and multiply the remaining heaps by 13, as before. Court cards count as ten.

41. *Iron Experiment.*

A simple illustration will serve to show two facts connected with iron; the first its elasticity, and the second the power exerted by pressure of the hand of any person. Make a hoop of one-inch square bar-iron, about the size of the brim of a man's hat; let the inside of the hoop be

made quite smooth and true. On examining such a hoop it would appear that the power even of a horse could in no way alter its shape or form, provided the strain be put to it fairly and equally. Now make a rod of iron of the thickness of a lead-pencil, that shall exactly fit the diameter of the inside of the hoop, so that, when placed in the hoop, it will not fall out unless the hoop be altered in shape. If, acting in a similar way, we take a child's wooden hoop, with a stick across it in the centre, and then press it at the sides opposite to that of the cross stick, the hoop will assume an oval shape, and, of course, the cross stick will fall out. Just so does the iron hoop described act: when anyone presses it, the iron rod falls out, showing clearly the elasticity of the iron. The hoop will become ovalshaped with a very little pressure, not greater than that which can be exerted by a young girl.

42. *A Pleasant Amusement for an Evening Party.*

There are few families in a position to give evening parties who do not introduce at times cards as an amusement. Various are the games invented for this purpose; and although the practice may be objected to by many, there can be no reason why they should not be employed as the vehicle of innocent recreation.

Raphael therefore introduces to the notice of his young readers the system of an amusement which is in itself perfectly harmless, and at the same time both amusing and interesting. In the words of a celebrated author, 'Divination (or that which is understood by the common term fortune-telling, and which of itself is both ambiguous and inapplicable) may be pursued in order to obtain an idea of the ultimate consequences of any act or thought, provided a system be uniform and carefully observed.' The same author further adds, 'that the sympathies of nature provide the means of elucidation, if the mind is sufficiently anxious.'

To this Raphael might raise some question. He however offers the following, hoping it may be productive of amusement in the sense he intends it.

Take a pack of cards, and we will presume the presiding genius to be a lady of very fair and light complexion: she will then be represented by the queen of diamonds, as persons of different complexions are represented by the different suits of the pack. Thus diamonds represent the fairest, hearts the next fair, clubs a dark complexion, and spades very dark persons. Ladies are represented by the queens of the respective suits, and gentlemen by the kings. The jack or knave of each suit represents the person's *thoughts* of that suit of which the *king* represents the party; thus

if the king of diamonds represents a very fair man, the knave of diamonds represents his thoughts. In order to proceed, let the cards be properly shuffled, and if the presiding personage tells his or her own destiny, he or she is represented by the card (king or queen, according to the sex), as above described, or if another person's, that person is represented in like manner. Suppose one is telling another their prospects; let that person cut the pack, after being shuffled, into three lots; then, taking up the lots indiscriminately, let the cards be laid out (faces uppermost) in rows of nine in a row; then, as there are fifty-two cards in the pack, there will be five rows of nine each, and one of seven at the bottom; these being laid on a table will form nearly a square. The representative card will of course be seen in one of the rows, and commencing with that as one, count nine cards in every way possible, then the cards ending at nine in the various countings will denote what is to come to pass, according to the following scale, and which must be applied to the best and most suitable advantage by the Consulting Oracle:—

Description of the Cards.—The ace of diamonds represents a ring; the ace of hearts, your house; the ace of clubs, a letter; and the ace of spades, death, spite, or quarrelling.

OF DIAMONDS:

The Deuce is money.
Trey „ speaking with a friend.
Four „ friends.
Five „ a settlement.
Six „ pleasure.
Seven „ money. Business.
Eight „ new clothes.
Nine „ business.
Ten „ a journey. Money.

OF HEARTS:

The Deuce is a visitor.
Trey „ a kiss.
Four „ a marriage bed.
Five „ a present.
Six „ courtship.
Seven „ friends.
Eight „ new clothes.
Nine „ feasting and courtship.
Ten „ a place of amusement or courtship.

OF CLUBS:

The Deuce is vexation.
Trey „ quarrels.
Four „ a strange bed.
Five „ a bundle or parcel.
Six „ trouble.
Seven „ a prison.
Eight „ confusion.
Nine „ a drinking party.
Ten „ going by water.

OF SPADES:

The Deuce is a false friend.
Trey „ tears.
Four „ a sick-bed.
Five „ a surprise.
Six „ a child.
Seven „ a removal.
Eight „ a roadway.
Nine „ a disappointment.
Ten „ sickness.

OF THE COURT CARDS:

The Kings represent males according to complexion.
The Queens represent females in like manner.
The Knaves, the thoughts of the respective parties.

Therefore, as example, suppose nine cards being counted out four different ways, or even more, and let the person be a young lady whose destiny is to be determined, and the six of hearts, the eight of hearts, the ten of hearts, and ten of

diamonds, are the four terminating cards; it is shown that the lady in question will speedily receive particular attentions from a gentleman; that she will have some new apparel, go to some place of public amusement, and take a journey, or have money given to her. Supposing the queen of the suit representing the lady in question, lying on the table faces to the right hand, and a knave or king of clubs is so placed as to look towards her, it shows the attention she will receive will be from a dark gentleman; if it is the knave, and very close, it may be one of the company, or near to her, or not residing far off; but if distant, he is from a distance. It is not imperative to lay the cards out in rows of nine each, only that it affords a means of counting to a greater number of cards.

When several diamonds come together, it is a sign of receipt of money; several hearts, love; several clubs, drink and debauch; and several spades, vexation or disappointment. Spades are the most untoward signification. A married lady, in reading the future, must make her husband king of *her* own suit; but a single lady must make her lover king of *his* own suit. The knaves of the suit are representative of their thoughts; so that what is ruling in their minds may be learned by counting from them, always taking care to include the representative card. A single lady may see how her lover is disposed towards

her by the way in which his representative card lies; that is, if the king or knave's face is towards her card, it is well; if the back is turned he is not true, or is inattentive, and his thoughts are directed to another object.

If any one desires to know if she will have her wish, let her shuffle the cards well (as she likewise must on other occasions), wishing all the time for some one thing; then cut them once, and, remembering carefully what card she cuts, she should shuffle them again, and then deal the pack into three parcels; look over each parcel, and if you find the card you cut in the first instance in the same parcel as your representative card, there are great hopes; if it comes next, or within one or two, *you will certainly have your wish*; if the nine of spades is in the same parcel, a disappointment awaits you as regards your wish; if the card (the nine of spades) is near your representative card, the disappointment will be heavy; and according as you find the cards run in the parcel where your representative card is, so you may judge of the wish being realised.

The nine of hearts is termed the *wish card,* and the seven of hearts the thoughts of the person whose destiny is being described, and according as these fall out in respect or next to other cards, must the result be construed.

This method of amusement is very innocent, tending to no bad results; it amuses the young

mind, and is decidedly preferable to giving an old gipsy a shilling, who only laughs at your credulity, and whose pretensions are founded on ready wit alone.—RAPHAEL'S *Prophetic Messenger.*

43. *Buttercup Art.*

Buttercup art has a wider range than its name infers, for it applies to nearly all flowers; hence the range of beautiful colours, tint, and shading. The art consists in arranging the petals of flowers into any form of acknowledged beauty, such as a Maltese Cross, a heart, a Union Jack, a crescent, diamond, or star, and also into any original forms which fancy may create. Thus the forms and colours may be varied without limit; hence there is in this occupation not only a source of amusement, requiring out-door exercise and in-door quietude, but there is room for the display of taste and genius.

The first process is an agreeable one to those who love the meadow, the field path, or the mossy bank of the rippling brook. It is to gather buttercups, corn poppies, forget-me-nots, and other flowers; the next is to take each flower cup singly, and pull off the petals or blossom leaves. These are then placed into a book, ranged in rows on about every tenth page; the book is then to be pressed either by being squeezed up tight in a book-case, or by having other heavy

books or weights placed upon it. By this means the flower petals will, in a few days, become quite flat and dry, yet retaining their brilliant colours and natural beauty of shading.

The heartsease will yield from each flower five beautiful petals; the wallflower, four; the buttercup, six; the lobelia, one; and the geranium, five. Whilst doing this, we are also studying a pleasant chapter in botany; for Linnæus has classified plants thus according to the number of petals in each blossom; so those having the same number of petals belong to one species.

Now, to obtain form, pattern, and design, we take a sheet of good writing paper, and draw upon it the figure we intend to produce in flowers; or, if the shapes be of the simplest kind (which they should be for the tyro in this pretty art), such as a heart or a diamond, then, instead of drawing the pattern, it can be cut off the paper with scissors; and this is easily done, as, if the paper be folded exactly in half, any shape that is cut on the side opposite to the fold will produce a perfect pattern, for when the fold of the paper is opened both sides will be sure to be alike. We now lift up one of the flower petals from the book in which it has been preserved, and then just wet it in the slightest degree like a wafer, but only on the under side, with the tongue, and then lay it on to the pattern; this we continue with more petals, till all the design is covered, overlapping

the rows of petals on to the former ones laid down, like tiles on the house-top. When the design is thus covered, the whole must be placed into a book; of course a valueless one is chosen for this purpose, because the flower-petals but too often stain the pages. It is then placed under pressure for a short time till quite dry, when it will be found that we can remove the flower-petal design from the paper pattern with the aid of an ordinary pen-knife.

When the flower pattern is lifted at the side from the paper, it can be stripped off like splitting a card that is wet. The petals adhere to each other sufficiently firm to become united as it were into one body; and when preserved in an album have a pretty effect from the combination of beautiful forms and colours; each specimen perhaps recalling some pleasant association, and, whilst it lasts, thus serving as an illustration of youthful ingenuity, and a souvenir of places we admired, persons we loved, and buttercup art.

44. *The Magic Egg.*

Take a pint of water, and dissolve in it as much common salt as it will take up; with this brine half fill a tall glass; then fill up the remaining space with plain water; pouring it in very carefully down the side of the glass, or into a spoon, to break its fall. The pure water will then float

upon the brine; and, in appearance, the two liquors will seem but as one. Now, take another glass, and fill it with common water. If an egg be put into this, it will instantly sink to the bottom; but if, on the contrary, the egg is put into the glass containing the brine, it will sink through the plain water only, and float upon that portion which is saturated with salt, appearing to be suspended in a very remarkable and curious manner.

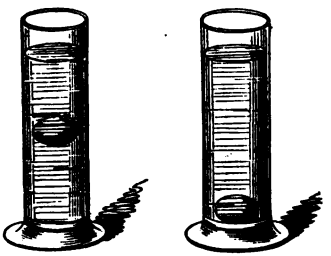


Fig. 14.

This trick has caused much astonishment when publicly exhibited, although its principle could be explained by every housewife who, before 'pickling,' tries the strength of the brine by observing if an egg will float on it.

45. *Fire upon Ice.*

If a piece of potassium be pressed with a penknife upon a cake of ice, the chemical action of the materials is so energetic that they burst into

a beautiful reddish-purple flame, and a hole is made in the ice where the potassium came in contact with it. Another way to make a fire is the following:—Make a hole in a block of ice with a hot poker; pour out the water, and fill up the cavity with spirits of camphor; the spirit may then be set on fire. It will have the singular appearance of 'ice in flames.'

46. *Fire by Percussion.*

Take a hollow cylinder, somewhat like the common syringe, of some bad conductor of heat —of wood or of thick glass—but with this difference, that, instead of one end having an orifice for the ejection of liquid, it must be perfectly closed; it must have a piston like the syringe, also a bad conductor of heat, and which must be made to move in the cylinder perfectly air-tight. Place a bit of tinder of amadou impregnated with a little nitre—that is, steeped in a solution of saltpetre in water, and then dried—in the cylinder, then place the piston at the cylinder's mouth, and with a sudden and powerful thrust condense the air in the cylinder: the tinder may thus be made to ignite.

47. *The Envelope Puzzle.*

This is a little conjuring conceit; and simple as it is, nevertheless, as we have found from long

experience in legerdemain, the simplest trick well done 'takes in' the most 'knowing ones.' You present to your friends an official letter, portentous in its length and breadth, bearing an inscription, 'On Her Majesty's Service.' From this envelope you withdraw another, on which is inscribed 'All Taxes on Industry are an evil,' and, on opening the letter, you find another directed, 'To Richard Cobden,' within which is another, addressed, 'Miss Emily Faithfull, London.' This, being opened, contains another directed to 'Mr. Karl Fröhlich, Pen and Scissor Artist, Frankfort;' and within it is another directed to 'Charles Dickens, Esq., Rochester,' which being opened contains a letter directed to 'Sir Humphry Davy, Penzance, Cornwall,' wherein is one inscribed, 'Dr. Johnson, Lichfield,' and within that is another directed to 'Admiral Benbow, Shrewsbury.' Opening this you find one directed to 'The Secretary, Puzzling Club, Enigma Chambers, Soho,' and within this is an envelope which, on being opened, is found to contain six white wafers. These wafers, after being carefully examined, are replaced in the envelope which, in its turn, is replaced in the one it came out of, and so on with all the others till they are again safely in the official letter, which you then place upon the table, that all may see it. You must next deliver a short lecture on the six white wafers, saying that 'White is the emblem of purity and innocence, of light and wisdom, and properly contains within

itself a combination of all other colours, as red, yellow, blue, green, orange and purple, which you will presently prove to the satisfaction of all present, and thus convince even the most sceptical, that, scientifically speaking, white is no colour at all, but a mixture of all the others, and all of which may be easily reproduced out of it, as they shall see before you have done. As to the six white wafers, they are emblematical of six great lights of science, Newton, Watts, Priestley, Davy, Brewster, and Humboldt, because as the sun's light is white, and dispels the darkness of the natural light, so too is the light of science, which dispels the darkness of error and ignorance, the night of the intellect.' However, enticing as the subject is, you cannot allow yourself to be led away by it, only in as far as it will enable you both to instruct and amuse, and to do this you must now call their attention to your again exhibiting, one by one, the letters or envelopes as before. Do this, and having reached at length the wafers, behold, instead of six white wafers, there will be six of bright colours—red, yellow, blue, green, orange, and purple, displayed before their eyes. All your friends will be surprised; all will wonder how the change has taken place, and how you did it.

Here is the solution. The envelopes are all in sizes, so that they can easily be placed into each other, but the wafer envelope is double, that is,

there are two envelopes of the same size pasted together face to face, and within one are placed the six white wafers, and within the other are the six coloured ones. The whole trick turns on the fact that you reverse the wafer envelope as you put it into its cover, which any adept at leger-demain can easily do rapidly enough, so that no one present can readily detect it.

48. *Walking on Red-hot Iron Plates.*

During a recent lecture at the Polytechnic Institute, London, the lecturer remarked that the setting of the Thames on fire was no longer a joke, but a reality. By dashing a small bottle of sulphuric ether with particles of metal potassium into a flat cistern, a bright flame was produced, which illuminated the whole place. He then laid four plates of red-hot iron on four bricks, and one of his attendants walked over them barefoot, without any injury. By wetting his fingers in ammonia the professor dipped them into a crucible of melted lead, and let the metal run off in the shape of bullets into a shallow cistern of water.

Boutigny first directed attention to this singular property of melted metals. Plucker of Bohn plunged his naked arm into melted bronze: he says the sensation was that of warmth only. When his arm was washed with water, and then

thrust into the melted metal bath, a sensation of cold was produced.

49. *Almanack or Calendar for Twenty Years.*

C B 1864		A 1865		G 1866	F 1867	E D 1868	C 1869	B 1870	A 1871	G F 1872	E 1873
D 1874		C 1875		B A 1876	G 1877	F 1878	E 1879	D C 1880	F 1881	E 1882	D 1883
1	8	15	22	29	Sun.	Sat.	Fri.	Thu.	Wed.	Tue.	Mon.
2	9	16	23	30	Mon.	Sun.	Sat.	Fri.	Thu.	Wed.	Tue.
3	10	17	24	31	Tue.	Mon.	Sun.	Sat.	Fri.	Thu.	Wed.
4	11	18	25		Wed.	Tue.	Mon.	Sun.	Sat.	Fri.	Thu.
5	12	19	26		Thu.	Wed.	Tue.	Mon.	Sun.	Sat.	Fri.
6	13	20	27		Fri.	Thu.	Wed.	Tue.	Mon.	Sun.	Sat.
7	14	21	28		Sat.	Fri.	Thu.	Wed.	Tue.	Mon.	Sun.
Jan. and Oct.					A	B	C	D	E	F	G
May					B	C	D	E	F	G	A
August					C	D	E	F	G	A	B
Feb. Mar. Nov.					D	E	F	G	A	B	C
June					E	F	G	A	B	C	D
Sept. and Dec.					F	G	A	B	C	D	E
April and July					G	A	B	C	D	E	F

Explanation.—Find the year and observe the letter above it; then look for the month, and in a line with it find the letter of the year; above that letter find the day, and the figures on the left in the same line are the days of the same name in the month.

Leap years have two letters; the first is used till the end of February, the second during the remainder of the year.

50. *The Moon's Influence on Man and Plants.*

The influence of the moon is admitted by all medical men practising in India. From infancy the natives of tropical climates are taught to believe in lunar influence, and that with good cause, for the intimate connection which exists between the new and full moon, the disturbed state of the atmosphere, and the attacks of epidemic, has been well ascertained. Two hundred years ago a physician, named Diemerbroeck, wrote a treatise on the Plague, in which he says, 'Two or three days before and after the full moon the disease was more violent; more persons were seized at these times than at others.' Many other authorities could be quoted to prove that the moon's influence is not to be regarded as purely imaginary, as is commonly the case. Many curious facts are recorded concerning the moon's influence upon the vegetable kingdom. It is stated that if peas are sown when the moon is increasing. they never cease to bloom; that if fruits and herbs are set during the wane of the moon they are not so rich in flavour nor so strong and healthy as when planted during the increase. In Brazil the farmers plant during the decline of the moon all those vegetables whose roots are used as food; and on the contrary they plant during the increase of the moon the sugar-cane, maize, rice, &c. The English gardeners observe similar rules

with regard to grafting, pruning, &c. From observations of Mr. Howard it appears that northerly winds are most frequent during a full moon, and south-west winds blow chiefly at the time of the new moon. It is also remarkable that rain falls most frequently during the last quarter of the moon, and that not a twentieth part of the rain of the whole year falls at full moon. 'Lunatics,' men under moon influence.

51. *A Paradox, and its Solution: an interesting Astronomical Fact.*

Two persons were born at the same place, at the same moment of time. After an age of fifty years, they both died, also at the same spot, and at the same instant, yet one had lived one hundred days more than the other. How was this possible? Not to keep our friends in suspense, the solution turns on a curious, but, with a little reflection, a very obvious point in circumnavigation. A person going round the world towards the west, *loses* a day, and towards the east, he *gains* one. Supposing, then, two persons born together at the Cape of Good Hope, whence a voyage round the world may be performed in a year; if one performs this constantly towards the *west*, in fifty years he will be fifty days *behind* the stationary inhabitants; and if the other sail equally towards the *east*, he will be fifty days

in *advance* of them. One, therefore, will have seen one hundred days more than the other, though they were born and died in the same place, at the same moment, and even lived continually in the same latitudes, and reckoned by the same calendar.

52. *The Letters of the Alphabet most used in Composition.*

A very correct idea has been formed, by examining the printer's case and the type-founder's scale, of the relative frequency with which the different letters of the alphabet are used. It has been found, on separating the letters which form words in any printed document, that for every 100 of the letter *z* distributed there are 200 of *x*, 400 of *k*, 800 of *b*, 1500 of *c*, 4000 each of *i*, *n*, *o*, and *s*; 4250 of *a*, 4506 of *t*, and 6000 of *e*. Thus it will be seen that the letter *e* is most used, and *t*, *a*, *i*, *n*, *o*, and *s*, are next in frequency of demand.

53. *The Magic Candle.*

The bungling way in which M. Frikell ignites a candle at Willis's Rooms, under the pretext of doing it by magic, induces us to explain to him and to our merry young readers the real way of performing this curious and (when properly

performed) astounding feat of legerdemain. M. Frikell requires a light! He then fetches a candle, the wick of which is prepared with match composition, in which is a glass-drop of sulphuric-acid; this being pinched, breaks, and the acid fires it; and with such a fizz, that the merest tyro in chemical magic at once sees into the secret. All the combustible potash compounds, though really useful in domestic matters, burn with that peculiar fizz detonation, that it is impossible for them not to be recognised by all who have struck a match; therefore, when a magician lights a candle, it should be done by a method unknown to the audience. The following, though more simple than the method adopted to deceive the public eye, will prove truly magical to those who witness it. Take an ordinary tallow candle which has burned for some time and has then been snuffed out; when the wick is quite cold place into it a piece of dry phosphorus about the size of a quarter of a pea. Now have by you a glass rod; this is to be your magic staff. Let a friend or the servant know before-hand that you intend to perform the illusion. M. Frikell uses no apparatus, has no 'preparation!' He of course has no one to do his wishes behind the scenes when he fetches the little etceteras he requires! —(this, however, aside). You ring the bell. 'Jane, bring a candle!'—'Yes, sir!'—'Let me see!—in the next room I have a magic rod.—

(Jane brings the candle.)—Dear me! why did you not light it? Ah! Well, never mind—I will do so.' Then with a pseudo-scientific touch of the wick with the rod, and behold, the candle burns! Those who were in the secret would have noticed that Jane placed the glass rod in 'position,' and that one end of it was nearly red hot. Chemistry tells all the rest—that a glass rod a foot long may be red hot at one end, and yet be cold enough at the other to handle; and that the heated end will be hot enough for some time to set fire to phosphorus, which burning silently and with intense heat, at once ignites the Magic Candle!

54. *Natural Crystals.*

The metals are frequently obtained in the crystallised state by fusion. If a few pounds of bismuth be melted in a crucible, and then allowed to cool until a pellicle of solid metal begins to form on the surface, crystals may be obtained by piercing this crust and allowing the still liquid portion in the centre to flow out. On breaking the shell which remains after this operation, it will be found to be lined with beautiful crystals of bismuth belonging to the cubic system. Lead, when heated in large masses, and slowly cooled, also deposits crystals, and on this circumstance is founded one of the more recent improvements

in the refining of that metal. Many volatile salts and other bodies may be obtained in a crystalline state by sublimation. In this way calomel, corrosive sublimate, camphor, iodine, benzoic acid, napthaline, and a vast variety of other substances, are crystallised and purified at the same time from the non-volatile substances with which they may be contaminated.

55. *The Feather Trick explained.*

Few of the illusions performed by M. Houdin at St. James's Theatre caused more astonishment than this one, yet no trick ever exhibited is more simple or easier of performance to the merest novice in the Magic Arts. A large cambric or white silk handkerchief is produced, and given to the company for inspection; on its being returned to the Magician he immediately brings from it several large plumes of feathers. The trick is performed thus:—Procure three or four large plumes of feathers from the military equipment warehouses, such as are worn by the officers or those of the foot guards at the side of their caps; take off your coat; then, holding a couple of the feathers in each hand so that they will fall towards the side of the arms, put the coat on again; this is easily done, as the feathers squeeze up to a very small compass. Thus equipped, you advance to the audience, and taking the handker-

chief, throw it over the one hand and cuff of the coat, and with the other hand draw out the feather from the sleeve; the feather resuming its original bulk entirely misguides the lookers on as to its previous position. One feather produced, the handkerchief is thrown carelessly over the other hand, and another brought forth in like manner, which can be repeated four times without causing suspicion. This new and ingeniously simple illusion is worthy of the inventor's magic renown.

56. *Transparent Painting on Linen.*

Very fine muslin is the best material for painting upon; and before you begin to paint, a straining frame must be made of beech or hard wood. It should consist of two upright bars, mortised at each end, with holes into which top and bottom cross-bars, tenoned at the sides, can slide, much after the same pattern as the ordinary embroidery frame, but it is rarely required larger than suitable for a window-blind. Along the inner edge of the frame a strip of webbing is permanently nailed, and to this the muslin must be sewed before it is stretched. Having stretched the muslin it is ready for the first preparation, which is sizing. The best size is that made from parchment cuttings; you must have a pipkin to hold about a quart of water. Having cut up the parchment into small strips, fill the pipkin with

water, and put them to simmer, but not to boil. When this operation has gone on for a couple of hours you will have sufficient size, which should be allowed to cool, and then you will have a clear transparent jelly. Remove the dregs from it and boil in a clean pipkin as much as you will require; but recollect, the more careful you are in the preparation of the size, the better will be the result of your workmanship.

After the muslin is sized it will be found to relax in the frame, and has therefore to be again fully tightened. A second or even a third coating of size is to be applied when the former is dry, and the muslin again stretched if it slackens. After a couple of days or more, when the size is quite hard, it must be rubbed smooth with pumice-stone—a smooth face may be obtained to the pumice-stone by grinding it on a stone flag with water. This operation of smoothing the size is very necessary, as the colours take better to the material than when this process is omitted. The muslin being now in a fit state to receive the paint, the subject of the design must be drawn upon it. In order to secure accuracy—for no 'rubbing out' can be effected on muslin—it is a common practice to draw the intended outline first upon cartridge paper with a bold stroke in ink, so that when fixed to the back of the muslin with threads it can be seen through the fabric, and the picture be traced out on the muslin

with a dark pencil. Another way of tracing a design is to employ the pounce-bag and a perforated pattern; thus, for instance, take a natural leaf, such as that of the vine or ivy, lay it upon a strip of cartridge paper, then perforate the paper all round the leaf with a pointer or a thick needle fastened into a handle. On removing the leaf a few perforations may be made to indicate the arteries. If several strips of paper are placed under the leaf at once, repetitions of the designs can be readily obtained.

The best pounce-bag is made of a couple of folds of muslin tied up like a laundress's blue-bag and filled with a finely powdered charcoal. The perforated paper patterns being placed on the muslin they are then pounced over, when the charcoal dust falls through the holes on to the muslin, and thus transfers the design of the leaf. If a border of leaves is required, it is only necessary to repeat the same leaf, but placed in different positions — now left, now right, then overlapping each other. The same may also be done with a butterfly or any similar object. Having perforated the design of a bird on the wing, it will not look like the same if its position is considerably altered, now flying up in mid-air, now alighting on to a bough, then descending; the subsequent colouring of the leaves, birds and butterflies, being also modified, changes their general appearance.

Many very elegant designs can be perforated by folding the paper once, twice, or four times; thus, whatever pattern is perforated will then be repeated through the other sections. In this way corners and centres are formed. The design thus placed in outline on the linen is now to be coloured. We of course presume that persons employing themselves thus will have some knowledge of art, and it is now that their taste can be displayed. The rules which govern art are applicable to transparent painting, but our observations are limited to the specialities required to put it in practice. A fine sponge forms a good tool to lay on the tints for clouds and sky or distant hills, and coarse honey-comb sponge does well for luxurious foliage, rocks, &c. Flat hog's hair brushes, the same as are used for oil painting, do admirably for this work. Varnish colours, tempered with japanners' gold size and turpentine, are the best; the paints sold in tubes will be found convenient, copal varnish and pale drying oil being used as a vehicle.

Young persons who can draw, and are in want of a little occupation, either for amusement or as a means of income, can now from these hints turn their attention to transparent painting; and there are too many ugly back windows to hide in every town for them to fear any lack of employment.

57. *Crystal Baskets.*

These pretty ornaments are not at all difficult to make. The basket, or any other ornament, is first fashioned with copper wire, as a skeleton of the pattern desired. For blue crystals, take a saturated solution of sulphate of copper in hot water, place the pattern in this liquor, and set it in a quiet place; as the solution cools, crystals of the sulphate will be deposited on the wire; the first crystals will be small; but, to increase their size, it is only necessary to place the ornaments in a fresh and perfectly saturated solution of the copper salt.

For Yellow crystals, use the yellow prussiate of potash.

For Ruby, use the red prussiate of potash.

For White, use alum, or acetate of lead.

The Salts of Chromium, and many others, are equally applicable for this purpose, if greater variety of colour be wanted.

To preserve these ornaments, in all their beauty, they should be kept under glass shades.

All the salts named are more soluble in hot than in cold water; hence, as the hot solutions become cold, a part of the material is deposited; in so doing, each metallic salt assumes a particular shape of crystal, as though endowed with vitality. These crystals vary in form according to the metal, but are invariably the same for the same

metal, and are as characteristic of their origin as a flower is of the parent plant.

58. *To Pass a Shilling into a Ball of Worsted.*

Like all the best magical tricks that are performed, this is one of the most simple in its principle. Few tricks of the Parlour Magic kind have caused more astonishment than this. A marked shilling is borrowed, a large ball of worsted is brought forward. Presto! The worsted is unwound, and out falls the very money which a minute ago was snug in its owner's purse.

Here is a solution of the mystery:—First procure a few skeins of thick worsted from a Berlin wool shop; next, a piece of tin bent in the shape of a flat tube, just large enough for a shilling to slip through, and about four inches long; now wind the worsted upon one end of the tube to a good sized ball. With a shilling in your *right* hand, you are now ready to 'show the trick.' Place the ball of worsted upon the sideboard, or anywhere out of sight. Borrow a shilling, which request to be marked, that the audience may be assured of its identity; then picking it up by the *left* hand, you now examine the shilling in your *right* hand, pretending that it is the one that has just been given to you, and observing that 'it is good,' place it upon the

table. You now fetch the worsted, quickly drop the marked money down the tube, and pull the ball off the tin directly it is in, advancing to the company, and winding up the ball, which, by a little pressure, secures the coin from coming out unless the worsted is unwound. Now put the ball into a glass tumbler, hold one end of the worsted a few yards from the glass, take up *your* shilling from the table, show it to the company (who will imagine it to be the one that was marked), say 'Presto! Fly! Pass!' give the end of the ball of worsted to one of the audience, request them to 'unwind it,' which being done, the money will fall out of the ball, to the absolute amazement of all who see this new and ingenious trick of legerdemain.

59. *The Philosopher Puzzled: To put Sand into Water without wetting it.*

A magician once sent a small bag of sand to an eminent philosophical chemist, accompanied by a note stating that, 'if a handful of the sand was carefully placed at the bottom of a vessel full of water, it might be removed in an hour's time as dry as when put in.' This statement being so diametrically opposite to the general nature of sand, caused some perplexity in the mind of the philosopher. On trying the sand as directed, he found the assertion quite correct; and was still

more puzzled in not being able to discern any apparent difference in the sand sent to him and ordinary sand. It was subjected to analysis, but without any further discovery; examined in every way, still nothing was elicited beyond the fact that this sand could be placed in water, yet not become wet. Though loth to confess his incapacity, the chemist at length sent to the magician for an explanation. This was the reply:—'Place a clean iron pan over a clear fire; into it put as much fine silver-sand as thought proper; allow it there to remain until it is hot enough to slightly brown a card used for stirring it. Now, to every quart of sand employed, add a piece of lard or tallow the size of a hazel-nut; mix it well with the sand, continuing the heat for two or three minutes, and it is then finished. When cold, it is the *Magician's Sand*, which cannot be wetted.'

When properly prepared there is not the least trace of grease on the sand.

60. *Chymical Transmutations.*

Linen can be converted into sugar; sugar into alcohol (spirits) and carbonic acid; alcohol can be changed into ether and water; sugar can also be converted into oxalic acid, also into pure charcoal (carbon) and water. *Alcohol* (spirits)

will readily change into vinegar (acetic acid). *Starch* may be transmuted either into gum, alcohol, sugar, acetic or oxalic acid, as well as many other substances, to which, however, the chymists have given such hard names that we cannot find a pen strong enough to write them.

Nearly all these changes are made to take place by boiling the material in water acidulated with sulphuric acid; or by mere contact with the acid in a concentrated state.

61. *The chosen one of forty-eight.*

Take forty-eight cards, deal them out in six rows of eight each, beginning at the top *left* corner; then, as they lie upon the table, there will be eight lines of six each the one way, and six of eight each the other way. The first we will call *rank*, and the other *file*; and this distinction being clearly understood, we may now begin 'to show the trick.' Ask one of the company to choose a card. This done, ask which file is it in. When answered, be particular to remember the top card of the file, for this one card is the key to the whole trick—so 'don't forget it.' The cards are now to be taken up exactly in the reverse order to that in which they were laid down, beginning at the *right* bottom-corner, picking the cards up the file to the top right-corner.

This done, the pack must be again distributed in the same order as before, and the question, which file is the chosen card in? repeated. Receiving the reply, you can instantly fix on the chosen card. The explanation is this: Remember the top card of the *file* the card is stated to be in. Then, when the pack is again laid out, it will be observed that all the cards that previously were in a *file one under the other*, are now all in a *rank, side by side* of each other. Now, seeing the position of the key card, that is, the one you had specially to remember, you will know that all the cards belonging to the *file* of which it was the topmost, now follow it in rank; consequently, the six cards that were in one file, are now distributed or divided into six files, one of its cards falling into each of the following files, when the reply is given to the second interrogation, the card thought of can be instantly picked out, because the file now given only contains one that was in the original file; and consequently, the card that is now in it, and which also formed part of the original file, must be the one chosen. After a little practice, half a dozen people may each choose a card at the same time, and you will be perfectly able to reveal all. Playing cards are not necessary for this trick, and forty-eight pieces of paper, numbered from one to forty-eight, will do as well, and then you ask what number is fixed *upon?* Again, take forty-eight names, as George,

Charles, Arthur, Ada, Jessie, Theodore, Septimus, etc., and the favoured name can be told in the same way.

62. *Hurdle Puzzle.*

A drover took to a cattle fair thirty-six lambs, which consisted of three different breeds, and with them twelve hurdles, so that he could make three square pens to hold twelve lambs each. This he did, and so positioned his pens that the dealers could go to all sides of them to examine the lambs. Next day the farmer sent twenty-four more lambs and three hurdles, with directions to the drover to set up two more pens into which the lambs were to be divided 'after their kind,' twelve in each pen. This the drover accomplished readily enough; now show me how he did it, before you look at the solution at page 125.

63. *Changeable Pictures.*

First sketch a landscape in Indian ink; it should represent either a winter scene or a mountain district, the snowy Alps or Pyrenees; when complete, touch the sky and frozen lakes with a solution of acetate of cobalt. The thatch of cottages, and some of the flowers, must receive an application of a solution of muriate of copper, the trees and sward are to be treated in a like

manner with muriate of cobalt. All these solutions should be used of various strengths, according to the depth of colour desired, and applied with artistic taste. These liquids will impart little or no colour to the picture, and when dry, it will remain, as before, 'a winter scene.' But if at any time the picture is held to the fire, or slightly warmed, the scene changes—the sky becomes blue, the ice and snow from the trees and grass melt away, and they assume a foliage of a lively green; the flowers alter in like manner, and a 'summer view' is represented. When the picture becomes cold, it passes again to its original tint. These 'chameleon pictures' are applicable for fire-screens, when placed in a frame between two sheets of glass; they also afford much amusement to young people, and exhibit strikingly the changes of matter by the application of heat. Mr. Naylor uses *bromide of copper* for making a *distinct dark outline*; visible when the picture is warmed, but invisible when it is cold. With this preparation a Magic Picture can be produced on plain paper, without any other solution or previous pencilling for the outline.

64. *Laughing Gas.*

This singular substance, discovered by Dr. Priestley, in 1776, was brought into particular *notice by* Sir Humphry Davy, the latter being

the first to observe its stimulating properties. When taken into the lungs, it induces the most agreeable state of reverie or intoxication, frequently accompanied with physical as well as mental excitement, which lasts for a few minutes, and then subsides without any unpleasant consequences. Persons who breathe it feel an indescribable pleasure and happiness: so much so as tc induce laughter, and hence the name (laughing gas) given to this substance, but which chymists call nitrous oxide. Enough laughing gas may be prepared for a single experiment by heating two ounces of nitrate of ammonia in a retort, having a large ox-bladder attached to collect the gas. The process is, first to insert into the neck of the bladder a wooden pipe, or stop-cock, made of elder, with the pith pushed out; next moisten the bladder, and squeeze it up, to remove the air; then fix it to the retort containing the nitrate of ammonia. Now heat the salt with a spirit-lamp: it first liquefies, then boils and decomposes, producing water (which remains in the retort) and the gas (which passes into the bladder); when the bladder is full, the experiment can be performed. Hold the bladder in the *left* hand, placing the thumb over the pipe to retain the gas; with the *right* hand close the nostrils; then empty the lungs by a long expiration; after which, insert into the mouth the pipe attached to the bladder, and breathe the gas in the same

manner as if it were common air; in one or two minutes, if the experiment be successful, an elysian sensation will follow, more exquisite than can be described, and perfectly harmless.

65. *Blind Speculation.*

The ordinary game of Speculation is too familiarly known as a merry game of cards to need more than its mere mention in connection with the mode of playing Blind Speculation, which yields more fun because there is 'more speculation' in it than in the regular game, though it differs from it only in one particular, which is this:—The 'turn-up' card is blind—that is, not revealed till all the hands are played; consequently if any good cards come up in the course of the game, it is impossible to be certain that they will be winners; for the queen of Hearts has no more value than the queen of any other suit, because we too are blind as to the suit of the 'turn-up' and so, having an equal value, they can be bought and sold accordingly; and speculating on the suits of the 'turn-up,' holders of cards of equal value can agree amongst themselves to share the pool in case either wins. Suppose the ace of Diamonds, the king of Hearts, the queen of Spades, and the knave of Clubs, represent the best cards out of each suit; yet the lowest card, that is, the knave *of* Clubs, must win, if a smaller Club be the turn-

up card. When all the hands are played, and all the bargains are duly noted, and terms of partnership agreed, then the dealer is to reveal the turn-up card—consternation to all other suits!—the turn-up being a Spade:—Hearts, Diamonds, and Clubs are now worthless. The turn-up proving better than any card yet played, wins. It is the king of Spades; and if the dealer has speculated and sold his turn-up, so much the better for the purchaser. Each player pays a counter into the pool, and the dealer two; whilst all knaves and fives turned up in the course of the game, pay one counter into it. Any number of players, more or less, can make a game. There are thirteen players round the table; twenty-six cards are already turned over; Emily has the best Heart. *Query*—How much may I justly 'speculate' to possess it? Can any of my mathematical correspondents assist me?

66. *The Balloon.*

A model balloon may be purchased at most toy shops.

Hydrogen gas is the best material to use for inflating it, that being the lightest substance known; coal gas is also used for the same purpose, but is inferior in buoyancy to pure hydrogen. This gas takes its name from the Greek, signifying its power to produce water when burned; in fact,

water is principally composed of hydrogen; we have, therefore, only to decompose water to obtain this subtle gas, and this is the way to do it:—Place about three ounces of zinc clippings into a wine bottle, then pour in half a pint of water, finally add a little sulphuric acid, enough to make the mixture effervesce briskly; this effect is caused by the escape of the hydrogen gas.

Now to inflate the balloon: fit a cork to the bottle, burn a hole in it with a red hot skewer, then fix a long piece of tobacco pipe into the aperture, wax it round to keep it gas tight; the hydrogen may then be collected by tying the neck of the balloon over the top. In about twenty minutes it will be inflated, showing its buoyancy by its erect position, and if disengaged from the pipe will quickly ascend to the ceiling, or to the highest part of the house, if it be let loose in the hall.

A car made of cork and suspended with silk, serves to ballast the balloon, and gives grace to its fairy-like motions through the air.

67. *How to cut a Visiting Card for a Cat to Jump through it.*

Cut the card through the centre, leaving a perfect bar at each end; then proceed by cutting the card according to the lines indicated in the subjoined engraving, taking care that you do not cut *through and thus* separate the links. When the

card has been thus carefully cut it may be drawn

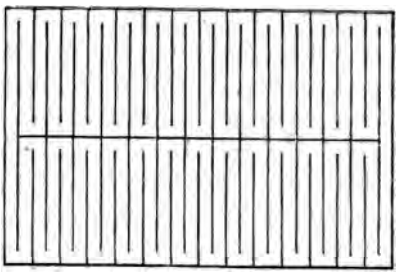


Fig. 15.

out to form a hoop for pussy to jump through, or it will make a pretty collar for her to wear.

68. *The Elastic Egg.*

Take a good and sound egg, place it in strong vinegar, and allow it to remain for twelve hours; it will then become quite soft and elastic. In this state it can be squeezed into a tolerably wide-mouthed bottle; when in, it must be covered with water, having some soda dissolved in it. In a few hours this preparation will restore the egg nearly to its original solidity; after which the liquid should be poured off, and the bottle dried. Keep it as a curiosity to puzzle one's friends for an explanation how the egg was laid in it.

69. *Mysterious Disappearance explained.*

This astonishing illusion has amused and surprised almost every person that has witnessed it, *not only in* England, but on the Continent

also, where jugglery is more in repute. A person is placed upon a table, and over him is put a large extinguisher, made of basket-work covered with calico; in an instant the extinguisher is lifted up, and, to the wonderment of the audience, the individual who was placed under it has vanished. This trick is thus performed. The table upon which the person stands seems to be an ordinary one, because you can see under it, and the coverlet being drawn aside, shows a top of the ordinary substance, which, however, is not so in reality; this innocent-looking apparatus being what magicians call a Bellows Table, from its construction resembling that well-known and domestic 'wind instrument.' The top is really double; the person who is about to 'disappear,' standing upon a particular part, opens a valve or trap-door; his weight is sufficient to extend the bellows, into which he stows himself like an oyster between two shells, till after the fall of the curtain. At the theatres these tables are sometimes set close up to a side scene, so that the person 'disappeared,' can be drawn out of the hiding-place, and hurried to a private box, where he fires off a pistol to denote his presence.

70. *To produce the Sensations of Heat and Cold at the same time.*

Procure three basins; into one pour warm *water of* 33°; into the second put water of 50°;

and into the third, water heated to 100°. Put one hand into the water of 33°, and the other into that of 100°. When they have remained so a few seconds, withdraw them, and immerse both hands into the water of 50°. The one which was before in warm water will now feel cold, and the one which was in the cold water will now feel warm.

71. *To Burn the Poker in the Candle.*

With a good rasp, file off an ounce from the fire end of a poker. The iron filings produced

FIG. 16.

are perfectly combustible, as may be proved by sprinkling them over the flame of a candle. As

they descend into the flame they take fire, each particle burning like a star — producing, in fact, miniature fireworks. Iron filings derived from any other source burn in the same way; but we choose the illustration of the combustion of those from a poker, in order to exemplify a fact in the 'chymistry of every day affairs,' which proves that iron in a solid mass will not burn, but that when divided into small atoms it takes fire even more readily than many things which are considered easy to burn. It is just for the same reason that Betty prefers lighting a fire with chips rather than with a log of wood.

72. *The Gyroscope: Extraordinary Effects of Motion.*

Let a beam, free to turn in all directions, be balanced horizontally on the top of a standard; then put a small wheel on one end, cause it to rotate rapidly, and the beam will still retain its horizontal position, notwithstanding the weight of the wheel. It seems as though motion nullified gravity. Professor R. Hunt explains this phenomenon thus:

'This instrument illustrates the law, that the axis of rotation is preserved, in any fixed direction, immovable, while the particles surrounding it are in rapid rotary motion. Hence the humming and the peg-top stand erect—the axis of

rotation—the spill or the peg being kept in a vertical position while in motion; it falls as soon as this motion sinks below a certain rate. The axis of the earth is maintained fixedly, pointing to the Polar Star, by the operation of the same law. This power may be illustrated by placing a disc of wood, or of metal, upon one end of a beam, from which one of the scales have been removed. The disc being equipoised by weights in the opposite scale; place the beam at an angle of 45°—the disc being the lowest end—then, by striking the disc, get it into rapid rotation. It will be found that, while spinning, the beam is preserved rigidly in its position; but, as the disc comes to rest, the beam is restored to its horizontal position. Several small weights may be placed in the scale, while the disc is rotating, without disturbing the position of the beam.'

Messrs. HORNE & THORNTHWAITE, of Newgate Street, manufacture this and many other ingenious philosophical toys.

73. *To prove that Plants obtain their principal Nourishment from the Air.*

It is now an ascertained fact that plants imbibe their chief food from the atmosphere. This truth is not yet sufficiently known to the world; but those who doubt it can satisfy themselves by the following interesting experiment: — Take a large garden pot, fill it with good dry mould, then

weigh it, being particular upon this point. Note the weight down in a memorandum-book for future reference. Now take a small slip of young willow, and having trimmed it so that it will strike root, carefully weigh that also; then plant it in the pot of mould, watering it from time to time; there is little to fear but that it will grow, and become a small tree; at that time, or when it is too large for the pot, the results may be noted. Pull up the tree; remove from the root all the earthy matter, which, together with the mould and pot, should be of the same state of dryness as when the experiment commenced; then weigh it. Now let the willow be dried, to free it from all extraneous moisture, and then weigh that also. The probable results will be that the earth will have lost about three ounces, and that the willow-slip will have gained four or five pounds. If the plant be burnt, the ash produced would account for the missing earth; the increase of substance to the plant, therefore, could not have been derived from that source. The truth is, that plants increase in weight only when in leaf; every leaf is a mouth, a stomach, and lung to the mother plant. By one of those beautiful operations of Nature, rendering all things subservient to each other, the wind blowing brings food to the trees and plants, which, were it not for the motion of the atmosphere, would be starved to death; they, not having the power of locomotion *to seek food,* must have their sustenance brought to

them. This experiment can be tried with any plant that will strike root from a cutting — as a vine, for instance; in fact, it can be done, if the weights be strictly attended to, with seeds, peas, or beans.

74. *The Pigeon's Nest.*

Shouts of laughter echo from room to room as the pigeon flies out of its nest. May be that instead of a pigeon you show the trick with a guinea-pig—poor little thing! as he goes running about hither and thither, the children after him, 'Queek! queek!' says he; and you have quite a compassion for the little creature. I will give a shilling, says Charley, to any one who will hold him up by the tail! With the pigeon matters are a little better; off he flies to the top of the book-case, and cooing, looks down upon his little friends with pigeon-like grace.

To perform this amusing conjuration make a box, in which is a drawer constructed as in the sketch A, Fig. 17. In the engraving the drawer is wide open and empty.

On close examination it will be seen, however, that this drawer in sketch A is but a case or outer cover to the real drawer shown at B, which slides in and out from the opposite end. At the bottom of the box a finger-hole must be made so that the *nest* drawer can be held back while the sham drawer is opened. (See the dotted lines in top cut.) The entire box when shut up

may be about nine inches long, and four inches square in width and depth; this size enables you to grasp it in one hand.

To do the trick, proceed thus:—Place your

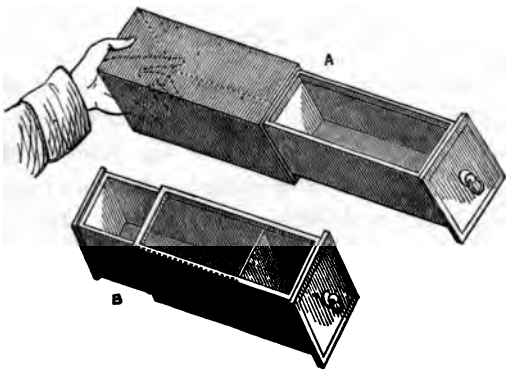


FIG. 17.

pigeon or guinea-pig in the nest drawer at any convenient time, advance to the company, tell them how that eggs were hatched in the time of Cleopatra in the Egyptian bakers' ovens (which is a fact); and how Mr. Cantello substituted steam and India-rubber in place of the natural warmth and softness of the parent bird's wings and feathers, with a like effect (which is a fact); and further how such wonderful things are done now-a-days, that by a new species of jugglery, you can hatch eggs into full-grown birds, by the mere 'heat of the audience's imagination.' Now grasp the box in your *left* hand, hold back the

nest drawer with the fore-finger, open the sham drawer with your *right* hand, show round that all may see it is 'quite empty,' and shut up again 'to hatch the birds.' Now, when opened, the nest drawer is allowed to come with the other, out the pigeon flies and all the rest is told.

75. *Improved Sight.*

Sometimes it happens that, either on account of a mist, or its being too dark, or not having an eye-glass, we are unable to make out a few letters or figures which it is most important to know for certain. In such case you may *make shift* to decipher them by placing the tips of your thumb and two forefingers so close as to leave but a small aperture about the size of a pin's head; by bringing this aperture close to your eye, you can approach the paper and read the characters much nearer than by ordinary vision, and thus make out what was before illegible. This make-shift will be found of great use on many occasions. A piece of card, or thick paper, pierced with a pin, will answer nearly as well, but these are not always to be had; the tips of the fingers, however, are always *at hand.*

76. *Curious Experiment.*

Take iron filings, three ounces; flowers of sulphur, two *ounces*; hot water, one ounce. Mix

these ingredients well together in as small a vessel as will contain them, and put it in a warm place. In less than half an hour the mass becomes heated, the water evaporates, and a dry black powder will be the result, in which no particle of either iron or sulphur can be perceived; in fact, a chymical compound is produced, namely, sulphide of iron. If iron and sulphur be mixed *without water*, no combination takes place. In this experiment the water effects the combination by being itself decomposed and giving rise to new compounds.

77. *Spongy Lead.*

This substance is easily prepared in the following manner:—A smooth plate of zinc is coated with a thick paste of sulphate of lead and water, about an inch deep. This is now placed in a vessel filled with a solution of common salt, in an inclined position, and just so that the liquid covers it, so that, in the decomposition, the salts, newly formed, readily flow off to the bottom. Upon the sulphate of lead another plate of zinc should be fixed. In the course of a fortnight, the lead salt is changed into a mass of lead sponge. This material is extremely well adapted for receiving impressions, for making models and matrices; also for galvanic and electrotype purposes. It will *doubtless rapidly* find other applications among

the arts. Under a powerful press it is converted into a flexible plate of metallic lead.

78. *Freezing Water in a Red-hot Vessel.*

At the late meeting for the advancement of science, Professor Boutigny perfectly succeeded in the freezing of water in a red-hot vessel. Having heated a platinum cup red-hot, he poured into it a small quantity of water, which was kept in a globular form, as in the other experiments. He then poured into the cup some liquid sulphurous acid, when a sudden evaporation ensued; and on quickly inverting the cup, there came out a small mass of ice. This experiment called forth loud and continued applause; and M. Boutigny appeared as much delighted as his audience at the success of his experiment. The principle on which this experiment depends is this:—sulphurous acid has the property of boiling when it is at a temperature below the freezing point: and when poured into the heated vessel, the suddenness of the evaporation occasions a degree of cold sufficient to freeze water.

79. *Beautiful Ornament for a Room.*

Dissolve in seven different tumblers, containing warm water, half-ounces of each of the sulphates of iron, copper, zinc, soda, potass, magnesia, and

alumina. Pour them all, when completely dissolved, into a large evaporating-dish, and stir the whole with a glass rod. Place the dish in a warm place, where it cannot be affected by dust, or where it may not be agitated. When due evaporation has taken place, the whole will begin to shoot into crystals. These will be interspersed in small groups, and single crystals amongst each other. Their colour and peculiar form of crystallisation will distinguish each crystal separately, and the whole together, remaining in their respective places where they were deposited, will display a very pleasing appearance. Preserve them carefully from dust.

80. *The Original Ghost.*

H. Dircks, Esq., in a paper communicated to the British Association, introduced a novel apparatus by which a sheet of plain plate glass was made to act as a mirror, and by whose powers many seemingly spectral illusions have been obtained. Its chief use will be as an adjunct to the stage, but as a home toy it will almost afford as much fun and wonderment as the magic lantern.

The arrangement of the apparatus is represented by the annexed diagram. A B C D E is a box closed on all sides, but provided on two sides with small doors, and on the top of the box are *the flapped* openings H I J. The interior of the

box is divided centrally by the partition K made of a good, clear, and even-surfaced piece of thin plate glass, kept in its place within two side grooves. The box is thereby divided into two

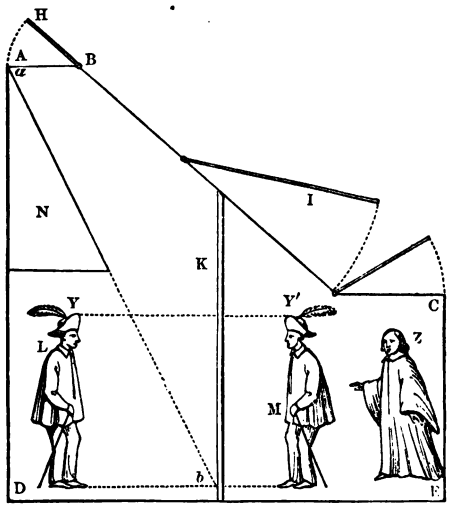


FIG. 18.

separate chambers or compartments, L and M, the former, L, having a ceiling or screen, N, to exclude any object therein from the direct view of the spectator, as shown by the line, *a b*.

If two figures be now introduced, one Y, the other Z, and the eye of the spectator be fixed at A, he will observe two images, one the real figure Z, the other Y', the mere reflection of Y. By this

arrangement it is evident that the plain unsilvered glass thus viewed at an angle of about 45° has all the properties of a mirror, but, owing to its transparency, two figures are seen possessing little or no distinguishable difference between them. Of course a person placed at Z sees only the figure Y; but as a piece of acting he may, under proper arrangement of a suitable stage, approach the situation apparently occupied by Y′, and thus indicate to spectators placed at A any pre-arranged dramatic scene requiring Z to be in correspondence with the visionary figure Y′.

In using the apparatus, the flap H must be open, but I may be shut, being mostly useful to get admission for inserting or withdrawing the screen or the figures. The flap J may be closed or opened to regulate the admission or exclusion of light. The two doors at the sides may both be wide open, though one is generally sufficient, provided it is turned as direct as possible to the light. A mirror placed at an angle close to the side doors will assist the illusion by illuminating the figure Y, and thus heightening the effect of the reflection Y′.

Some of my ingenious readers should set to work and construct one of these apparatuses, and see how it works; they will then learn that the Stage Ghost is produced with but a slight modification of this optical toy.

81. *Optical Amusement.*

Pierce a card with a small hole; and holding it before a window or white wall, a pin, being held between the eye and the card, will be seen on the other side of the orifice inverted and enlarged. The reason of this phenomenon, as M. Lecat has observed, is that the eye sees only the image of the pin on the retina; and since the light which is arrested by the head of the pin comes from the lower part of the window or wall, while that which is stopped by the lower end of the pin comes from the upper part, the image must necessarily appear inverted relatively to the object. JAMES HOW, 3 Foster Lane, City, is a maker of all sorts of optical lenses, prisms, and galvanic apparatus.

82. *A Tree without a Root.*

Science sometimes attains curious results, as is fully attested by the following experiment made by the celebrated Hales. He attached the eastern branch of a young tree to its neighbour by inarching, and its western branch to another neighbour in the same way; and, after they were firmly united, he cut the stem of the middle tree from its roots, and thus left it hanging in the air by its two inarched limbs, where it flourished with considerable vigour.

83. *Parlour Magic.*

If two white pebbles, commonly called 'milk stones,' be strongly rubbed together in the dark, a considerable quantity of light will be produced. Two pieces of borax have the same effect. If a lump of sugar be snapped asunder in the dark, a streak of light will also be visible at the instant of separation. Common fluor spar, or Derbyshire spar, if made hot in an iron ladle, will, in a dark room, shine like a star, or a glow-worm.

> These, to the unlearned eye,
> Show oft like magic; but grandam Wisdom
> Knows them as recreations of young Science,
> In sportive mood, upon a holiday.

84. *Magic Mirrors.*

An interesting paper was read at a late meeting of the Paris Academy of Sciences, by M. Stanislas Julian, on the metallic mirrors made in China, and to which the name of 'Magic Mirrors' has been given. Hitherto all attempts by Europeans to obtain information as to the process, in the localities where they are manufactured, have proved failures; some of the persons applied to being unwilling to reveal the secret, and others being ignorant of the process. These mirrors are called magical, because if they *receive the rays* of the sun on their polished

surface the characters or flowers *en relief*, which exist on the other side, are faithfully reproduced. The following information has been obtained by M. Julian, from an author named Ou-tseu-hing, who lived between 1260 and 1341. This author says:—'The cause of this phenomenon is the distinct use of fine copper and rough copper. If, on the other side, there be produced, by casting in a mould, the figure of a dragon in a circle, there is then engraved deeply on the disc a dragon exactly similar. Then the parts which have been cut are filled with rather rough copper, and this is, by the action of the fire, incorporated with the other metal, which is of a finer nature. The face of the mirror is next prepared, and a slight coating of tin is spread over it. If the polished disc of a mirror so prepared be turned towards the sun, and the image be reflected on a wall, it presents distinctly the clear portion and the dark portion, the one of the fine and the other of the rough copper.' Ou-tseu-hing states that he had ascertained this by a careful inspection of the fragments of a broken mirror.

85. '*Clairvoyance*' *explained.*

The art of telling the name of an article, the number on a bank-note, the colour of a substance, the name of a metal, the value of a piece of money, the nature of a precious stone, and

other things, by a person whose eyes are blind-folded, has been called *Clairvoyance, Second-Sight,* or *Double-sight.*

The 'Mysterious Lady,' and other persons pretending to this apparent faculty, have, from time to time, appeared before the public for the above purpose, causing a degree of astonishment in the minds of the audience almost without parallel; hence these exhibitions have been denominated 'Magic,' a name which implies an effect without a known cause. By a known cause we mean that which is patent to the world, and not to the individual.

From the time when the Oracles of Delphos were consulted to our own day, man has invented things to astonish his brethren; and until the secret of one has been explained, and another invented, these mysteries have continued.

Before science was made a branch of polite learning magic had full sway, and was believed to be a gift from the Spirit of Evil to those men who paid tribute to his Satanic Majesty. Happily for the present age superstition has passed away, and we are no longer horrified by hearing that a 'learned judge' has ignorantly condemned such and such a person to be burned for witchcraft, which, unfortunately for the many poor creatures who suffered, was the case in the time of 'good Queen Elizabeth,' and even at a more recent period.

Clairvoyance, like all the presumed magical

arts, astonishes people no more when the matter is explained to them. They are then surprised at their own dulness and incapacity 'to see through' such a simple thing.

The whole system of presumed 'double-sight' rests with two persons—one who advances to the audience *to receive* the article desired to be experimented upon, and who *asks a question* of the other; and the blind-folded person, *who replies.* The effect of these questions and answers being arranged into a system and order, constitutes the whole art of Clairvoyance.

Every question has a corresponding answer; and, to be perfect, requires a good memory—not more, however, perhaps, than that required of an actor who learns 'a part' in a new tragedy. The simplicity of the questions principally misleads the audience, being no other than an ordinary interrogation which any one would make; modified only by an understanding between the confederate parties, that the same sentence, differently arranged or put, calls forth a different reply, thus,—

Question. Is it plain or ornamented?
Answer. Ornamented.
Question. Is it ornamented or plain?
Answer. Plain.

We will now give a few illustrations of the system of questions and answers, premising that the same order can be, and is frequently, carried

out to a very elaborate extent. First, then, we have questions relating to colours, precious stones, metals, wearing apparel, jewellery, numbers and dates, money, miscellaneous articles, &c. &c.

FOR COLOURS.

Question. What colour is it?—*Answer.* Black.
Q. What is the colour?—*A.* Blue.
Q. Tell me the colour?—*A.* Green.
Q. Has it a colour?—*A.* White.
Q. Any colour?—*A.* Orange or yellow.
Q. Name the colour?—*A.* Brown.

FOR METALS.

Q. What metal?—*A.* Gold.
Q. What is the metal?—*A.* Silver.
Q. Tell me the metal.—*A.* Copper.
Q. Name the metal.—*A.* Iron or steel.
Q. What metal is it?—*A.* Brass.

FOR STONES.

Q. What stone is it?—*A.* Jet.
Q. What is the stone?—*A.* Topaz.
Q. Tell me the stone.—*A.* Emerald.
Q. Name the stone.—*A.* Diamond.
Q. Do you know the stone?—*A.* Cornelian.
Q. Any stone?—*A.* Amethyst.

MISCELLANEOUS ARTICLES.

Q. What have I here?—*A.* A purse.
Q. What is this?—*A.* A toothpick.
Q. Name this.—*A.* A pocket-comb.
Q. This will puzzle you.—*A.* Court plaister.
Q. Speak loud.—*A.* A letter.
Q. Answer instantly.—*A.* A handkerchief.
Q. Has it a colour?—*A.* White.
Q. Is it perfumed?—*A.* Yes.
Q. Tell me now.—*A.* Keys.
Q. Is this of any use?—*A.* An almanac.

Q. What should be done with this?—*A.* Burn it; a cigar, or cigar-case.

Q. Do ladies or gentlemen use this?—*A.* Ladies; a needle-case, or pin-cushion.

Q. Do you know this?—*A.* Yes—well I remember it—a cane or walking-stick.

Q. Now can you tell?—*A.* A pocket-book.

Q. Is this for any purpose?—*A.* A reticule.

Q. How do you tell what I possess?—*A.* By sympathy—a ring.

ARTICLES OF JEWELLERY.

Q. Would you like this?—*A.* Yes; a watch.

Q. Do you admire this?—*A.* A brooch.

Q. Who gave me this?—*A.* A lady—a bracelet.

Q. What is now in my hand?—*A.* A breast-pin.

Q. Now, who gave this?—*A.* A gentleman—a chain.

Q. Tell me, instantly, who gave this.—*A* A lady—a chain.

MONEY.

Q. What have I now?—*A.* Money.

Q. Now what have I got?—*A.* A sovereign.

Q. Can you tell again?—*A.* Half-a-crown.

Q. Is this the same?—*A.* A shilling.

Q. You say I have money, but don't tell me the coin.—*A.* A florin.

Q. You say I have money; why not tell me the value, if you can see it?—*A.* Half-a-sovereign.

Q. I cannot hear you.—*A.* A bank-note.

Q. What is its value?—*A.* Five pounds.

Q. Of what value is it?—*A.* Ten pounds.

Q. Can you tell its value?—*A.* Twenty pounds.

Q. How much is it worth?—*A.* Fifty pounds.

The above illustrations are sufficient to show the plan of simple questions; but as it frequently happens that *particulars* of the articles are required, they then become complex, but are no

less easily understood than the simple questions, because the latter are only combinations of the former. Thus,—

AN ARTICLE DESCRIBED.

Q. 1. Is this for any purpose?—*A.* A reticule.
Q. 2. What colour is it?—*A.* Black.
Q. 3. What have I here?—*A.* A purse.
Q. 4. Tell me the colour?—*A.* Green.
Q. 5. What have I now?—*A.* Money.
Q. 6. I cannot hear you.—*A.* A bank-note.
Q. 7. Of what value is it?—*A.* Ten pounds..
Q. 8. Is this the same?—*A.* No: a shilling.
Q. 9. Tell me now?—*A.* Keys.
Q. 10. Answer instantly?—*A.* A handkerchief.

It should be understood that the questioner, during the process of eliciting the answers, uses such actions as are necessary to call forth the replies. After the second question is answered the reticule is opened, and the purse (if any) taken out; the purse is also opened, and the note or shilling, as the case may be, is brought forth. These being returned to the bag, the keys or handkerchief are removed before the ninth or tenth question is put.

ANOTHER ARTICLE DESCRIBED.

Q. Would you like this?—*A.* A watch.
Q. What is the metal?—*A.* Silver.
Q. Now who gave this?—*A.* A gentleman; there is a chain attached.
Q. Of what metal is the chain made?—*A.* Gold.

OTHER ARTICLES DESCRIBED.

Q. Do you admire this?—*A.* Yes, a brooch.
Q. Do you know the stone?—*A.* Yes: cornelian.

Q. Has it a colour?—*A.* White.
Q. Now can you tell?—*A.* A pocket-book.
Q. What is the colour of the leather?—*A.* Blue.
Q. Speak loud! (here the book is opened)—*A.* A letter.
Q. The wax—'what colour is it' sealed with?—*A.* Black.

We have now given sufficient explanation and illustrations to show the basis of this system. Those who wish to practise it must invent a vocabulary of their own, or make such additions as are necessary to render it complete. The most numerous or various questions are required for the 'Miscellaneous' articles expected to be met with in a large party; but we doubt not that many of our readers will readily accomplish the task; and, when learnt, it will afford much amusement to themselves and friends.

86. *The Game of Scissors.*

This game, which is a great favourite of both sexes in France, would be a very agreeable one to introduce at our English picnic or gipsy parties. The method of proceeding is this:—Various prizes, such as neck-ties, handkerchiefs, trinkets, &c., are suspended by means of thread from a branch of a tree, or from a line, the ends of which are fixed to the trunks of two trees standing at a short distance from each other. The competitors for the prizes have their eyes bandaged; they then, with scissors in hand, advance and endeavour to cut down a prize. To

render this the more difficult, the left hand is secured to prevent their feeling for the object which they are attempting to reach with the scissors. In order, too, to prevent any friendly hint from reaching the ear, a drum or some other noisy instrument should be used (as in France) to drown the sound of the voice. Not only on a green lawn in the summer, but in a snug room during the winter evenings, this amusing game might be resorted to; and, in the latter case, a lady might play on the piano Mozart's rattling overture to Don Giovanni, which would be a good substitute for the drum while the game is going on. Only one person at a time is allowed to try for the prizes, and the time of trial is limited as may be agreed upon.

87. *Curious Experiment: a Solid produced by mixing two Liquids.*

In a wine-glassful of water dissolve as much chloride of calcium as the water will take up; in another wine-glassful of water dissolve as much carbonate of potash as will saturate the water. If the two *transparent liquids* be now mixed together in a tumbler, a *solid* will be produced.

88. *To change the Colour of a Flower.*

If the stem of a white rose be placed in a *solution of yellow* prussiate of potash for four or

five hours, and then placed in a solution of sulphate of iron, the colour will be changed to a delicate primrose, while the fragrance remains unchanged. The pink candy-tuft will change to an emerald green by the fumes of tobacco. Purple dahlias can be tipped with white, and a scarlet dahlia tipped with yellow, by holding the flowers over the fumes of burning sulphur.

89. *The Three Halos.*

The following experiment, which illustrates in a pleasing manner the actual formation of halos, has been given by Dr. Brewster:—Take a saturated solution of alum; and having spread a few drops of it over a plate of glass, it will rapidly crystallise in small flat octahedrons, scarcely visible to the eye. When this plate is held between the observer and the sun, or a candle, with the eye very close to the smooth side of the glass plate, there will be seen three beautiful halos of light, at different distances from the luminous body.

90. *To find the Difference between two Numbers, the greater of which is unknown.*

Take as many nines as there are figures in the smaller number, and subtract that sum from the number of nines. Let another person add the

difference to the larger number, and taking away the first figure of the amount, add it to the last figure, and that sum will be the difference of the two numbers. *Example*: John, who is 22, tells Thomas, who is older, that he can discover the difference of their ages; he therefore privately deducts 22 from 99 (his age consisting of two figures, he of course takes two nines); the difference, which is 77, he tells Thomas to add to his age, and to take away the first figure from the amount, and add it to the last figure, and that will be the difference of their ages; thus: —

The difference between John's age and 99 is . .	77
To which Thomas adding his age	35
The sum is . .	112
Then by taking away the first figure 1, and adding it to the figure 2, the sum is	13
Which added to John's age	22
Gives the age of Thomas	35

91. *Vapourgraphic Glasses.*

An ingenious person may afford 'no end' of amusement to himself and friends by the aid of a few dozen magic vapourgraphic glasses, on which are invisibly delineated a variety of questions and answers of an appropriate character, such as love-questions, conundrums, &c. Real 'dissolving' *views may also* be depicted on these glasses, pos-

sessing an interest according to their artistic value. Glass Valentines may also be made in the same way, which may have invisibly impressed upon them any written theme, poetry, or initials—

> Breathe on this glass, and you'll divine
> The portrait of your Valentine.

These vapourgraphic glasses are very easily made, and at a cost not worth mentioning. When finished they have nothing peculiar in their appearance to indicate their latent graphic powers; hence, to a stranger to the mystery, they only appear like ordinary glass. The secret is this:—Procure a few pieces of window glass, about the size of an ordinary playing-card, then write or draw on them whatever may be thought proper with a quill pen that has been dipped in *hydrofluoric acid*, using this watery liquid just as you would ink. After the design has thus been depicted upon the glass for about two minutes, the glasses are to be washed in clean water, and polished with a silk handkerchief or a dry soft cloth. The drawing or writing will now be perfectly invisible, but, if breathed upon, the pictures or letters become 'as clear as noonday.' The same effect is observed if the glasses be held over the steam of hot water; hence their name *vapour* or steam; *graphic*, relating to writing. Hydrofluoric acid, as it eats into glass, is sold in leaden bottles by the laboratorian 'hymists.

92. *The Magic Coffee-pot.*

Although the atmosphere may seem to us almost destitute of weight, compared with the solid and liquid bodies of which the earth is mainly composed, it nevertheless possesses actual weight, and, like all other gases, exerts its pressure in all directions alike. It is in this respect especially that gases differ from solids and liquids, for the latter have only a tendency to press downward, while gases in general, from their extreme

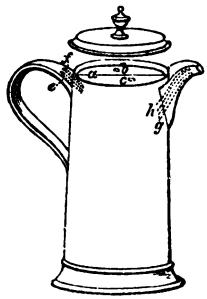


Fig. 19.

elasticity and the mobility of their particles, press as much in an upward as in a downward direction.

If it were not for this circumstance, any soft object on the earth would be completely crushed by the weight of the surrounding air; for it is found that the atmosphere presses with a weight of nearly 15 lbs. on every square inch of all objects on the earth's surface; a weight which

would be sufficient to overwhelm most of the works of nature, if there were not a corresponding pressure in an exactly opposite direction to counteract its effect. Such being the case, it will be readily understood why a tube, open at one end and sealed at the other, may be filled with water and inverted with the open end downwards, without the liquid escaping. The *upward* pressure of the air (not being counteracted by any *downward* pressure) acts upon the under surface of the water, thus opposing the natural tendency of the liquid to fall, and causing it to retain its position; but if a hole be made in the sealed or upper end, the *upward* pressure of the atmosphere on the *under* surface will be counteracted by the *downward* pressure on the *upper* surface (which has now free access to the air), and the water will fall by its own weight.

The principle and action of the Magic Coffee-pot will now be clearly comprehended. The pot is divided into two compartments, *b*, *c*, each of which has a pipe, *h*, *g*, connected with the spout, and another leading through the hollow handle to the two little openings, *e*, *f*. Thus each compartment has two independent openings. The pot being uncovered, coffee is poured through *b* into the one compartment, and milk through *c* into the other, and the corks and lid are replaced. Now, if the *thumb* be placed upon the two openings

e, *f*, neither coffee nor milk will be able to be poured out; for the pressure of the atmosphere at the spout is not counteracted, and therefore keeps both liquids in their respective compartments; but if the thumb be skilfully withdrawn from the aperture *f* and retained on the opening *e*, coffee will obviously escape from the spout on tilting the pot; if, however, *f* be kept closed, and *e* opened, the milk will escape, and if the thumb be removed from both apertures, the milk and coffee will issue from the spout together. The effect of this trick is very startling, for the Coffee-pot, which at first appears to be empty, may be made to discharge coffee, milk, or coffee and milk together at the pleasure of the company.

93. *Little Experiments.*

A few pretty little experiments, timely introduced at a juvenile party, will prove not only a source of entertainment to several of the juveniles themselves, but will also afford, by the time they occupy to show them, an opportunity to Mamma and to Aunty to 'arrange' the small affairs which they may have in contemplation as to the best mode of enabling twenty persons to sit at a table which at the utmost is sufficient only for twelve. Then again, it is the diversity of entertainment which causes a party to 'go off' well. To spend *three hours in a* domestic circle at one occupation is

truely 'a bore,' says Charley; and Papa even thinks it as dull as reading a long trial in the newspapers: one turns to the advertisements with pleasure for a change. Dancing is all very well for the 'third age;' but the 'second age' delights in the marvellous. The mental eye of youth is transported with delight at the colours of a soap-bubble. Red fire and blue flame are their delight, and the fiz of wildfire and the bang of a cracker a source of pleasure. As there is no denying this fact, let us minister to their pleasures by showing them a few nice and harmless experiments.

Fire from a liquid and a dry salt. — Reduce to fine powder some chlorate of potash; then mix it with an equal weight of powdered white sugar. This done, have a small bottle of sulphuric acid, and dip into it a thread of string, and the liquid will adhere to it; after which touch the mixed powder with the wet string, and a splendid blue flame of intense light will be instantaneously produced. When exhibiting this curious experiment, it is well to place the powder on to an old plate in the chimney corner; the smoke will not then incommode the visitors.

Before you are going to have 'the party,' make some lime-water, by putting a piece of quick lime, the size of a walnut, into a wine bottle full of cold water that has been boiled. Shake it, and then it

will settle and become clear. Pour out some of the lime water into a glass, and it will appear like ordinary water. Now, to ascertain if a youngster of the party loves truely, ask him to blow for a minute or so through a straw or long piece of tobacco pipe into the water. This will cause the clear, bright water, to turn milky. Pass your wand over the glass before he does this, and say: —

> If you love Rose as Rose loves you,
> This water will remain both bright and true;
> But if to her you false would be,
> Then milky it will turn—as all will see.

Of course you will use any name, instead of Rose, suited to the case. If the blowing is fairly done, the water will be sure to turn milky, and raise a general laugh to the delight of all — saving, perhaps, the luckless wight who has had a 'blow.'

Potassium is now comparatively cheap; yet it is at all times a means of 'astonishing' the young. Put a basin of cold water into the middle of the room; make all visitors stand round it at a respectful distance; then drop one globule of potassium on the water, and it will instantly ignite, and swim about alight on the surface of the water, thus proving that to set the Thames on fire is, after all, a very possible event.

Bisulphide of carbon dissolves phosphorus. If

a few drops of this solution be poured upon paper, and the paper is placed out into the garden, it will astonish all who behold it to observe that it will take fire spontaneously in about a minute, and burn with a brilliant white flame.

Solution of the Hurdle Puzzle, p. 87.

	First Day.	Second Day.
First Day.	Second Day.	First Day.

94. *To tell a person any number he may privately fix on.*

When the person has fixed on any number (say 6), bid him double it, and add four to the doubling; then multiply the whole by five; to the product let him add twelve, and multiply the amount by ten. From the total of all this let him deduct 320, and tell you the remainder; from which, if you cut off the two last figures, the number that remains will be the one he fixed on.

Example.

6	16	92
2	5	10
12	80	920
4	12	320
16	92	600

95. *Black Peter.*

There is a game, very popular in Germany, called Black Peter. A pack of cards is dealt out in equal numbers to the company, three of the four knaves having been previously withdrawn. Each person then examines his cards, and pairs off as many as possible, casting the pairs into the middle of the table. This done, the dealer turns his hand back upwards, and offers to the person on his left the choice of a card. This person, having drawn one, tries to pair it with one in his hand; and thus he in his turn offers those he has remaining to his neighbour. And so the game goes round—it being the object of every player to get rid of all his cards, by pairing them off as rapidly as possible. One card, however,—the knave—cannot be paired: and the person who is left with this Black Peter in his hand is the loser. The game is a lively one; since every player to whom Black Peter is passed endeavours to assume a careless air and give it to his neighbour.

96. *Triplicity of the Year* 1857.

The following are some of the curiosities of the figure 3, in relation to the figures of the year 1857:—First, add all the figures and divide the sum obtained by the last figure in the *year*, $1+8+5+7=21\div 7=3$. Second, add the

second and fourth figures, and divide the sum by the third, $8+7=15\div5=3$. Third, add the second and fourth, then subtract therefrom the sums of the first and third, $(8+7)-(1+5)$, and the quotient will be 9, the second power of 3. Fourth, multiply the first and second figures, 1×8, and subtract this sum from $5\times7=35$, the quotient is 27, the third power of 3.

For duplicity we must look to the year 1861, which, by the mere addition of all its figures, gives the fourth power of 2 (16).

97. *Hot and Cold, White and Black, Water in one Vessel.*

Pour cold water into a tumbler till it is three parts full; then put a piece of card to float on it; now pour hot water on the card, which will break its fall; the hot water will then remain in the upper part of the glass, while the cold water will be at the bottom. If we reverse the order of this experiment, placing the hot water in the glass first, and afterwards the cold water, the whole will quickly mix and become of one uniform temperature. If either the hot or cold water be coloured with a little ink prior to the experiment, we shall have not only a hot and cold, but also a black and white liquid in the same glass. The explanation of this little experiment

is simple enough. Hot water is much lighter than cold water, hence the former will float upon the latter. Perhaps, dear reader, you can now understand why when cold milk is poured into hot tea, it sinks instantly to the bottom of the cup.

98. *The Temperance Cup.*

Who hath woe? Who hath sorrow?
Who hath contention? Who
hath wounds without cause?
Who hath redness of eyes?
They that tarry long at the
wine! They that go to
seek mixed wine! Look
not thou upon the
wine when it is red,
when it giveth its
colour in the
CUP;
when it
moveth itself
aright;
AT
the last
it biteth like a
serpent, and stingeth like an adder.

99. *Magnetic Phantoms.*

The name of phantoms has been given to the fantastic forms which iron filings affect when strewed over a sheet of paper stretched quite flat; *and if the paper* be covered with a glutinous

matter these figures will naturally become permanent. Magnets, moreover, produce another kind of phantoms; for it is well known that under magnetic influence, iron filings will bristle up, rising to appreciable heights above the surface on which they had been strewed, and at the same time hanging together in virtue of the attractive power with which they are animated; so that solid figures in relief are actually formed but fall to atoms as soon as the magnet is removed. The following is the method of fixing the phantoms:—First impregnate the paper with wax, stretch it on frames, and then, after having strewed iron filings upon it, place it upon the poles of the magnet under experiment. The phantoms are soon formed, and in order to fix them, hold a hot brick, or the red hot lid of a crucible, over the surface of the paper, taking care not to touch it. The wax melts, and is drawn up by capillary attraction between the particles of iron; the heat being removed, the wax cools, and the phantom is thus permanently fixed. It is singular to see the wax sucked up by the filings through the above-mentioned agency of capillary attraction, and the paper quite denuded of wax, although thickly covered with it before. It may be asked what is the advantage derived from this discovery? It is this—that from the curious grouping of the particles of iron, permanently kept in the exact position into which they had been placed by the

magnetic force, the nature of that force, which is still a mystery, may be carefully studied, and perhaps ascertained.

100. *The Remainder.*

A very pleasing way to arrive at an arithmetical sum, without the use of either slate or pencil, is to ask a person to think of a figure, then to double it, then to add a certain figure to it, now halve the whole sum, and finally to subtract from that the figure first thought of. You are then to tell the thinker what is the remainder.

The key to this lock of figures is, that *half* of whatever sum you request to be added during the working of the sum *is the remainder.* In the example given five is the half of ten, the number requested to be added. Any amount may be added, but the operation is simplified by giving only even numbers, as they will divide without fractions.

Example.

Think of	7
Double it	= 14
Add 10 to it	10
Halve it	½)24
Which will leave	12
Subtract the number thought of . .	7
THE REMAINDER will be	5

101. *A Brown Paper Electrical Machine.*

A simple, cheap, and effective electrical machine, according to M. Thore, may be made by joining the ends of strips of paper about eight inches wide, so as to make an endless band, and stretching it on two wooden pulleys covered with silk, one of which is rapidly turned by a handle. M. Thore states that electricity was developed by pressing a warm flat-iron upon the paper as it passed over one of the pulleys, the warm iron taking the place of 'the rubber' in the ordinary machine and that the effect so produced was remarkable. It is also asserted that a machine so constructed may be worked under atmospheric conditions which would arrest the action of those ordinarily in use.

102. *Phosphoric Oil.*

Nothing in the world is more like 'bottled moonshine' than phosphoric oil. A light without heat! — astonishing! — but it is so. The light emitted by phosphoric oil is an unearthly spiritual kind of light, just such as would interest those readers who are expected to read this little book. However near we are to its luminous influence, it nevertheless always appears to be at a distance. As it is probable that light from this source will have a practical application in places where the common artificial light would

be dangerous, we shall explain the process of making it, for the entertainment of our young laboratorians, many of whom may, perhaps, live to see the phosphoric lamp used in dangerous mines. For experiment take a thin glass vial; about half-fill it with fine olive oil; then drop into it a piece of phosphorus the size of a bean; now place the bottle in boiling hot water until the oil is quite hot; shake it now and then, and the phosphorus will dissolve; keep the vial well corked; then let it get cold. Whenever you want a little moonshine, take the cork out of the bottle, shake the oil, and there will be light!

103. *Cards and their Origin.*

There lies a deeper meaning in this game, as in chess, than may be generally known or acknowledged. These four drawings signify the four conditions of Society, the church, *coppe*, the priesthood; the sword, *spada*, the nobility and military; money, *danari*, the trading classes, burghers; and clubs, *bastoni*, the lower order, or peasantry. Each division runs from one to ten; then follows the *fante*, pedestrian or plebeian; *cavallo*, horsemen, knights; and *Re*, the general or supreme head; so the four orders contend under the influences of cunning and luck, which gives the advantage first to this party, then to that, now to the other. The French cards, like

the German, are later importations and translations from the Italian : we give the names in each language: —

Coppe . .	Cœur . .	Herz . .	Hearts.
Spado . .	Piques . .	Schippen . .	Spades.
Danari . .	Carreaux . .	Schellen . .	Diamonds.
Bastoni . .	Trefle . .	Laub . .	Clubs.

At the same period the knight was transformed into lady or queen; the striking coincidence of the four divisions of the pack, with the Indian castes, encourages the idea of the eastern origin of this game, an origin which probably might be referred to very distant ages.

104. *Change of Colours.*

Make an infusion of logwood in the same manner that tea is made; the only precaution is, not to make it in a metallic vessel. Now pour out some of the logwood tea into four wine-glasses; to one of the glasses add a few drops of vinegar, to another put in a few grains of alum, and into the third glass a few grains of green copperas (sulphate of iron); in the fourth glass the liquid may be left of its natural colour, while the three former will be changed respectively into red, blue, and black. An infusion of red cabbage will change in the same manner, and becomes green by the addition of a few drops of hartshorn.

105. *The Number Eleven.*

There is a curious property of the number 11, which, perhaps, may not be generally understood, viz.: — *In any multiple of* 11, *the sum of the odd digits is equal to the sum of the even, or their difference is divisible by* 11. Thus, in the number 7975, the sum of the odd $5+9=14$, and the sum of the even $7+7=14$. Consequently, a number divided by 11 leaves the same remainder as the sum of the even digits subtracted from that of the odd; as, for instance, 9876543 divided by 11 leaves a remainder (6), and 18 (the sum of the even digits) subtracted from 24 (the sum of the odd) leaves the same remainder (6). Should the sum of the even exceed the sum of the odd, 11, or a multiple of 11, must be added to the latter before subtraction. As I am at a loss for a good explanation of this singular property, I shall leave the subject to the consideration of some of my more talented readers.

106. *To make Sulphur Coins.*

Prepare first the requisite moulds of both sides of the coin, by pouring plaster of Paris on each side alternately. Make a line, or other mark, on each mould, to show the position that they are afterwards to be placed in, that the heads and devices may be in such a position relative to each

other as they are in the original coin. Then melt some sulphur (that is best which has been melted two or three times before, so that it has acquired a light brown colour). When ready to pour, hold the two moulds at the proper distance from each other, according to the thickness of the coin, and with the marks of both in a line with each other, and wind round the edge of the moulds a strip of card, in such a manner that the card shall go very nearly round them; a small vacuity only being left at the top. This being prepared, hold the card between the fingers and thumb, then pour in the sulphur, and as it shrinks pour in more, until the space between the moulds is full. It will immediately congeal, and, when, removed, it will be found to have taken a fine impression from the moulds, and to have all the sharpness of the original coin. When taken out, it may be trimmed with a knife around the edges, for sulphur has the property of remaining soft for some considerable time after melting. To give the artificial coins clearness, and an appearance of antiquity, they must be rubbed all over with blacklead, and then the blacklead removed from the more prominent parts with a soft damp rag. A fine metallic appearance is given to medals by varnishing over the blacklead surface with a weak solution of dragon's blood in spirits of wine, by partially rubbing the blacklead off. The moulds must be damped previously to using.

107. *To Silver the Interior of Glass Vessels.*

The following is the formula from the specification of the patentee:—One ounce of the spirits of hartshorn, or ammonia; two ounces of nitrate of silver; three ounces of spirits of wine; three ounces of water. One ounce of this solution is mixed with a quarter of an ounce of grape-sugar (honey will do—*S. P.*) and a quarter of a pint each of spirits of wine and of water; it is then filtered, and is ready for use. It is applied to the glass, and the vessel put into water at a temperature of 160° Fahrenheit, remaining in contact therewith till the silvering is effected. It should be borne in mind that all the quantities above given can be divided, if the experiment is required to be tried on a small scale. [The writer finds from actual experiment, this to answer perfectly, and adds that the interior of vessels may be 'coppered' by an analogous process, using the ammoniacal solution of copper in place of the silver salt — other ammonurets of metals also act in the same way — thus is extended the application of the patentee's process.]

108. *Solid Steel will float on Water.*

If the blade of a well-polished knife be dipped into a basin of cold water, the particles of each of these two bodies do not seem to come in contact *with each other;* for when the blade is taken out,

the water slides off, leaving the blade quite dry, as if it had previously been smeared with some greasy substance. In the same way, if a common sewing needle be laid horizontally on a glass of water, it will not sink, but forms a kind of trench on the surface, on which it lies and floats about. This proceeds from the little attraction which exists between the cold water and the polished steel. It is necessary that both the knife, in the former experiment, and also the needle, should be dry and clean; otherwise the effect will not be produced. The needle must be carefully placed on the surface.

109. *Ornamental Eggs.*

When eggs are to be ornamented, the vital principle is first to be destroyed by boiling them in water for five minutes. Eggs are easily dyed of various colours; such colouring substances as are soluble in water will nearly always stain an egg-shell. When an egg is wrapped up in a piece of scarlet cloth and boiled for an hour in water, it will have a beautiful rose colour. Eggs may be rendered blue by boiling them in water containing a little prussiate of potash, and when dry dipping them for a minute or so in cold water that contains a little sulphate of iron. Turmeric in water stains an egg yellow. Sumach, Brazil wood, and other dye-stuffs, impart various hues, all of which may be modified in tint by being dipped a

second in alum water, salt of tin, sulphate of iron, &c. So much for "golden eggs." *To produce figures in relief upon eggs* we have first to draw the design, whatever it may be, on the shell, with tallow. After the grease has been properly absorbed, the egg is put into strong vinegar. The acid dissolves those parts of the shell that are not touched with the grease; and thus, after the egg is finally cleaned with soap, the design, being untouched by the vinegar, remains in relief. By judiciously using a dye-stuff after the acids, and before the final cleansing with soap, a white figure in relief may be produced upon a coloured ground. Again, by drawing a picture with a grease crayon, and then placing the egg in the dye-bath, coloured pictures may be produced without the use of vinegar. Pencil sketches upon eggs are also very effective, the form assisting perspective. These drawings may be fixed by a coating of white varnish.

110. *Anderson's Scrap-Book Trick.*

When a couple of hats, a basket of flowers, two bonnets, a portmanteau, and a bird's cage suddenly make their appearance from between the covers of a scrap-book, it certainly does at first sight seem to be very wonderful; yet if any illusion of the public conjurors be less deserving of the title of 'legerdemain' than another, it is the trick of *the scrap-book.* The whole of this deception is

explained by stating that the articles produced are mechanically constructed upon the same principle as the gibus, or French opera hat, or the caspiato, or folding bonnet, as sold by Mrs. Smith, of Regent Street. A bird's cage can as easily be made to fold up as the wire framework of a hat or bonnet; so likewise can a sham portmanteau or a basket. In the sham portmanteau the wirework is covered with japanned cloth, in imitation of solid leather. Although a bad stage trick, yet an ingenious lad can make it a good one to amuse his friends at 'the old house at home,' and cause some merriment at the festive season. The scrap-book is constructed like a chess and backgammon board, many of which fold up hollow in the centre to hold the men, and are bound at the back to represent a book. When the articles are made, which, when wanted, are to spring up like 'Jack-in-a-box,' they are to be placed severally in the book; then, after the usual cabalistic formalities, each article is to be brought forth from time to time. If your grandma is looking on very intently through her specs, it is ten to one but that she whispers in your pretty cousin's ear, 'Bless the boy! I always said he was clever!'

111. *Sympathetic, or White Ink.*

Writing with this ink is not legible until acted upon by some chymical agent. It is principally

used for secret correspondence, both political and private. Prior to the establishment of the Penny Postage, it was greatly used to defraud the Government, by persons sending intelligence thus written upon newspapers. One of the simplest forms of its preparation is to dissolve one ounce of sulphate of iron (green vitriol) in two ounces of thin gum-water. Writing executed with this fluid is invisible, but is immediately developed by brushing the part over with strong tea, coffee, or an infusion of nut-galls.

Another form is a solution of acetate of lead (sugar of lead) in water. Writing done with this liquid instantly becomes of a yellow colour by drawing over it a feather, previously moistened with an aqueous solution of sub-borate of soda (borax).

The chloride of copper, or cobalt, also answers well for sympathetic ink. It should be used in the same way as for 'Changeable Pictures,' described at p. 87.

Writing done with milk, or lemon juice, upon paper, is rendered visible by being made very hot, but cannot be depended on with certainty.

112. *Living Cribbage.*

Fifteen players are entered for this game, thirteen are to personify 'cards,' while two are chosen '*to play the game*;' each person is to be named in

this way: thirteen cards, from ace to king, are to be laid upon a table face downwards, choosing one each. Whatever the card be, that in future is to be the name of the drawer. Thus, Arthur is a king, Emma is a queen, Charley is a knave, George is an ace, Septimus is a seven, Jessie is a five, and so on; to prevent error, every card is to be placed in the pocket or reticule of its owner. Play! The room being cleared, those who are to play the game are to stand one at each side at the head of the room. All the 'cards' standing in a row, they are now to be shuffled;' this is done by anybody going anywhere and anyhow; and finally, at a word from the players, 'Pack the cards!' they range themselves again in a row or 'pack,' without any reference as to who or what they are. The players then say, 'Cut for deal!' Three 'cards' are then to be taken by each player, and whatever be at the bottom of each 'cut' being named, the lowest takes the deal. The cards used for the 'cut' are now replaced, and the whole of the cards are again 'shuffled,' and again ranged in a row, This causes a good deal of fun. They must now be dealt alternately by the person who won the deal, five cards to each player; at the same time the 'cards' take their place at each side of the room. The players now examine their 'hands,' make their choice, retain three, and reject two each for the 'crib.' The crib are now to take

seats while the game is played. 'Cut for turn up!' As there are but three cards now remaining of the pack, the middle card is to be the 'turn up.' The game is now played exactly in the same way as a regular card game, the court cards counting ten. Now for the first fifteen—two! Sequence—three! made when you can. Twenty-eight—a *go*? No, three are thirty-one! —two holes; and one for my last card. The non-dealer must now count and 'take' his hand; this done, the dealer does the same, not forgetting his 'crib.' The score may be kept on a regular board, and if two lads are in company they may act as 'pegs.' All the points being taken, the whole of the cards are to be again 'shuffled' to the tune of Roger de Coverley, if there be a piano in the room. Thirty-one is the winning point of living cribbage, and until that point be gained the remainder of the game is but a repetition of what has already been explained. The players' task is to be perfectly familiar with the personified cards, for if either 'revoke' the game is lost, and new players have to be selected. The fun of living cribbage lies in the pantomimic action of the 'cards,' their manner of stepping from hand to crib, their quick appearance when 'played,' the ever-changing company which consitutes the 'hands,' the uncertainty of who will be kept in hand and who 'thrown out' for *crib, who will* be 'turn up,' and when there *will be 'a flush.'*

113. *The Parlour Laboratory.*

Of all the sciences, operative chymistry is the most popular. To be delighted and amused all the while we are learning a difficult task so allures us over every lesson, that we may cease to wonder how nearly all the renowned chymists have in their youth been only 'boys fond of experiments.' That the world may reap the benefit of the talent of some future philosopher, we shall now show how to arrange a complete laboratory for a few shillings. Dr. Wollaston used to say that all the chymical experiments which lecturers show to their pupils could be exhibited on a tea-tray. So convinced was he that large and costly apparatus was unnecessary, that he used to show many electrical phenomena with a galvanic battery constructed out of a split farthing and a lady's thimble. He was, in fact, the first chymist who introduced chymistry into the parlour. Let us follow his example. The first thing requisite to be procured is a common table with a drawer about half a yard wide and one yard long. Round the back and sides there must be a ledge two inches high, also an inner bar or ledge, between which four dozen vial bottles will stand in a single row round your parlour laboratory, for such we must now designate what was before merely a table. Six of the vials are to have glass stoppers; the remainder are to be fitted

with corks. These bottles will contain the various chymicals and tests for future experiments. A small retort-stand is easily made with a round stick inserted in a six-inch square block of wood; some stout iron wire twisted into form will make the rings for it to hold flasks, evaporating dishes, &c. A lamp is readily constructed out of a short wide-mouthed bottle fitted with a bung, through which passes a piece of glass tube to receive the wick. A small wood box, put together with white lead at the joints, is everything that could be desired for a pneumatic trough for the manipulation of gases, &c. A gallipot filled with kitchen grease, into which is inserted a thick bunch of wick, forms an excellent lamp for blow-pipe analysis. Blow-pipes are purchased for sixpence each. A shilling spent at the old bottle shop will supply the remainder of all the apparatus required, such as a couple of oil flasks, a wide-mouthed bottle to hold half a pint for a gas jar, and some pomatum pots; a common tea-saucer answers well for our evaporating dish. So now for chymicals—sulphate of iron, sulphate of copper, prussiate of potash, nitrate of barytes, phosphate of soda, oxalate of ammonia, carbonate of ammonia, caustic potash, common salt (chloride of sodium), gall nuts, sulphide of potassium, are all to be had in portions from a pennyworth to three pennyworth. These are to be *dissolved* severally in distilled water, and put into

the corked bottles. These form the principal tests in the process of analysis. In the stoppered bottles we must put sulphuric acid, nitric acid, muriatic acid, strong ammonia; these are the principal substances used for dissolving metals, earthy rocks, &c. In the other bottles we keep such substances as phosphorus, sulphur, chlorate of potash, nitre, borax, alum, potassium, iodine, indigo, chlorine water, lime water, manganese, acetate of lead, starch, sugar, alcohol, naphtha, oil, &c. In the laboratory drawer should be found test paper, pliers, wire, dusters, and such-like, in various divisions. As a pen is to a clerk, a hammer to a carpenter, so is a test-tube to the experimental chymist. The mere addition of heat to an enormous variety of materials, produces the most wonderful changes in them. Test-tubes being made of glass, we can see these changes take place when an experiment is made in them. Twist a wire round a test-tube to form a handle: any material then put into the tube can be exposed to the intense heat of the lamp, and the result, often very wonderful, duly noted. Numerous experiments for the winter evenings may be performed with this laboratory.

First Experiment. Prepare the variety of solutions or tests, otherwise called re-agents, to fill bottles around the laboratory table for future use. Water will dissolve or melt some substances, such as sugar, or salt; but not others, such as chalk or

glass. Of substances that dissolve in water, it will be discovered that they are soluble only in certain definite quantities; thus, 100 grains of water will dissolve 37 grains of dry salt. If, therefore, we put fifty grains of salt into 100 grains of water, there will be 13 grains of salt not acted upon by the water. The solubility varies for nearly every salt, and when the water will dissolve no more, it is said to be 'saturated.' All the saline ingredients that we dissolve for the re-agent bottles are to be thus made into 'saturated solutions,' and thus we shall obtain a saturated solution of nitrate of baryta, saturated solution of prussiate of potass, &c.

Second Experiment. This consists of precipitation. Take a test-tube, pour into it a little solution of sulphate of copper, then a few drops of solution of carbonate of potass; from these two clear bright liquids an opaque turquoise precipitate falls. Add a few drops of strong ammonia, and the whole will again become quite clear, and of a colour transcendently blue. Then add a few drops of nitric acid, and again the precipitate will appear. In this way an *endless* variety of precipitates can be produced, and of various colours.

Third Experiment. Pour some sulphuric acid into a test-tube, and add an equal quantity of water, the two *cold* fluids will become quite *hot.*

Fourth Experiment. Half fill a large test-tube with powdered muriate of ammonia, grasp the tube in the hand, then fill it up with water, and the *sensation of cold* will instantly be felt.

Fifth Experiment. Put a little nitrate of potass in a test-tube, pour on it the same bulk of sulphuric acid, warm the mixture over the lamp, when *nitrous acid fumes* will arise.

Sixth Experiment. Dissolve a quarter of an ounce of sulphate of soda in two ounces of water, boiling hot, set the mixture aside to cool in a corked bottle placed in a quiet place; when quite cold draw out the cork and touch the liquid with a grain of sand, and the whole fluid *will instantly crystallise.*

Seventh Experiment. Place a few grains of mercury in a test-tube, pour on it a little nitric acid, warm it, and the *metal will be dissolved*; add water, and you will have a solution of nitrate of mercury; test it with a solution of hydriodate of potass, or carbonate of ammonia. Note the results; remember the note-book!

Eighth Experiment. Put a little muriatic acid in a test-tube, gradually add to it carbonate of soda, till the mixture ceases to effervesce, then taste it, observe the strong *acid is neutralised,* and that common table-salt is produced.

Ninth Experiment. Take a solution of common

table-salt, either produced by the last experiment, or by dissolving salt in water, add to it a few drops of solution of nitrate of silver, and you will observe that a *white precipitate* falls; pour this on to a piece of writing-paper, and expose it to the light of day, or the sun, and it *will become black.*

Tenth Experiment. Take a saturated solution of sulphate of magnesia—Epsom salts—pour into it a like quantity of solution of potass, and the *two liquids will become solid.*

Eleventh Experiment. Place about three or four grains of chlorate of potass, and two grains of sulphur in a mortar, rub them together and briskly *detonating reports* will occur, as the pestle goes round the mortar.

Twelfth Experiment. Pour a little boiling water on to a few slices of beet-root, or of red cabbage, divide the red fluid into several glasses. To one add a few drops of ammonia, to another a few drops of muriatic acid, to a third a little alum, to a fourth potass, and so continue with several reagents—note the great *variety of colours produced.*

We have now shown you a few experiments that can be exhibited with a parlour laboratory, but in point of beauty and number, they are but as a few grains of sand blown from the sea-shore, of what remains for you to behold.

114. *The Kaleidoscopic and Prismatic Spinning Top.*

A very pretty and philosophical toy has been invented by Mr. J. Gorham. We will attempt to describe it, in order that some of our juvenile readers may entertain themselves and companions with it during the holidays. The toy can be purchased very elegantly made for a guinea at Mr. ELLIOT'S, 30, Strand; but as this sum probably exceeds the assets of the ordinary 'pocket-money' of youth, many of our ingenious readers may construct a substitute for themselves, and this they can do at very little expense. We must premise by mentioning the following optical facts. There are but three true colours—yellow, red, and blue; these colours combined in different proportions produce all other tints, such as orange from red and yellow, purple from red and blue, and so on. If a card-board wheel or disc be divided into 360 spokes or degrees, and 30 of them be coloured red, 165 blue, and 165 yellow, then if the wheel be rapidly turned round—that is, revolved—none of the colours are visible, but a neutral grey-white is the result. Yellow 15, blue 15, red 15, black 315, produces brown. Endless other shades and tints can be made in the same way by varying the colours and proportions. Mr. Gorham's plan is to have half-a-dozen card discs of different bright-coloured card-paper, green, blue, red, black,

yellow, and white, five inches in diameter. In the centre a perfectly round aperture is made, about three-tenths of an inch in diameter. From this aperture a slit is cut through the card in a straight line, from the centre to the outer edge; this done, one disc can be put into another and all thus made to overlap each other. By this clever contrivance three or four cards can be put together of different colours, and just as much of each colour as is required brought into view by

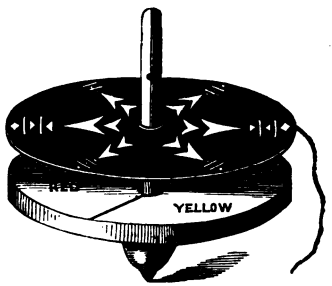


FIG. 20.

twisting each card. The motive power to set the discs rotating is a top, like a large tetotum, five inches and a half in diameter. It is made to spin like a humming top. The spindle or axle of the top should be about four-tenths of an inch in diameter. The coloured discs are put upon the spindle, and the top is then spun in the usual way. Various combinations in the form of the disc, such as heart, diamond, &c., will suggest themselves to lie upon each other. We have now come to the

most curious part of the top. If a disc of three colours, say red, yellow, and blue, be placed on the top, and the top be spun, the colours will be blended into a sort of drab. Then if another disc be dropped on to the spindle while it is rotating, and this second disc has a pattern cut into it like perforated card of particular designs (see engraving), we shall see all the colours of the first disc divided as though it were stationary, and the original colours, red, blue, and yellow, are perfectly visible in their pristine hue! Only one thing is necessary to ensure success, and that is, that the pattern-disc, called the kaleidoscopic disc, does not rotate so rapidly as the coloured disc. The rule is that the colour-disc rotates five times as fast as the pattern-disc. This is easily effected by fastening a piece of string to each of the pattern-discs, which acts as wings and retard its motion. The pattern-discs are best made of black paper card, as the colours show up better through a black ground. Coloured paper fastened in segments to a common humming-top will illustrate many optical principles of the kaleidoscopic top.

115. *The Protean Light.*

Soak a cotton wick in a strong solution of salt and water, dry it, place it in a spirit lamp, and when lighted it will give a bright yellow light for a long time. If you look through a piece of blue glass at the flame, it will lose all its yellow

light, and you will only perceive feeble violet rays. If before the blue glass you place a yellow glass, the lamp will be absolutely invisible, though a candle may be distinctly seen through the same glasses.

116. *The Walking Shilling.*

To perform this trick, first procure a long and strong human hair, to each end of which fasten a small piece of cobbler's wax, about the size of half a pea; place one end in the waistcoat pocket, and the other hold between the forefinger and thumb of the right hand; then ask one of the company for a shilling, and in taking it from them press the wax to the under side of the money; then place the piece down carefully on a table or in a wine-glass. On moving gently away, and making (as a feint) an enticing noise with the lips, the shilling (being drawn by the hair) will of course follow. So again, by putting the piece on the extended hand, and moving the arm forward, the money will appear to pass along the hand in a very strange manner. You may also place the money in a drinking cup, and then entice it out in the same way, causing much fun and laughter. A little practice is, of course, necessary to perform this legerdemain well; but, when done nicely, it causes much astonishment and wonder to those who see it for the first time.

117.

Song of the decanter.

There was an old decanter, and its mouth was gaping wide; the rosy wine had ebbed away and left its crystal side; and the wind went humming—humming, up and down the sides it flew, and through the reed-like hollow neck the wildest notes it blew. I placed it in the window, where the blast was blowing free, and fancied that its pale mouth sang the queerest strains to me. 'They tell me—puny conquerors! the Plague has slain his ten, and War his hundred thousand of the very best of men; but I'—'t was thus the Bottle spake—'but I have conquered more than all your famous conquerors, so feared and famed of yore. Then come, ye youths and maidens all, come drink from out my cup, the beverage that dulls the brain and burns the spirits up; that puts to shame your conquerors that slay their scores below; for this has deluged millions with the lava tide of woe. Though in the path of battle darkest waves of blood may roll; yet while I killed the body, I have damned the very soul. The cholera, the plague, the sword, such ruin never wrought, as I, in mirth or malice, on the innocent have bro't. And still I breathe upon them, and they shrink before my breath; and year by year my thousands tread the dismal road of Death.'

118. *Experiment to set the Thames on Fire.*

The most miraculous effect may be produced by means of the metal potassium, namely, causing water to burn. When it was first discovered by Sir Humphry Davy, the large laboratory of the Royal Institute in Albemarle Street could not contain the concourse of people who came daily to witness its effects; it caused more astonishment than any other substance which science has revealed, excepting perhaps phosphorus, which was exhibited at every court in Europe. We have merely to drop a piece of potassium into a basin of water, which, though quite cold, instantly bursts into a beautiful and brilliant flame wherever the metal is in contact with it, and continues to burn until the potassium is quite dissolved. Sufficient may be procured from any operative chemist for a shilling, to exhibit this wonderful effect several times.

119. *A Recreation.*

The possibility of putting a bulk so large as twenty shillings, weighing four ounces, into a wine-glass already full to the brim with water, may be doubted; yet, with a steady hand, it may be thus accomplished. First, procure a wine-glass, wipe it perfectly dry inside and out, espe-

cially round the rim; pour the water gently into it from a spouted mug until the glass is full to the brim; then drop the shillings edgewise gently in. Immediately the edge of the shilling touches the water, let it fall. Be careful not to wet the edges of the glass. Spring water answers better than soft. Having completed your task, you will observe, with surprise, how very much the water now stands above the level of the brim without flowing over; this is caused by the 'cohesive attraction' of the water being greater than the 'attraction of gravity.'

120. *To produce Figures or Representations upon Glass.*

Take a print, lithograph, or engraving, or design drawn by hand with printers' ink, and fix the printed surface to the glass by means of ordinary paste, with great care to exclude the air. When perfectly dry, apply to the paper liquid hydrofluoric acid, specific gravity 1·14, for about three minutes, after which wash off the paper, and the figure or representation is found on the glass. Of course the printers' ink protects the glass from the action of the acid. The inventor prefers to have the glass finely ground, enamelled, or veneered, before he applies his process, when the picture stands out in relief. If the veneer or enamel is coloured, of course the picture remains

coloured, and the body of the glass is white. Very pretty effects may no doubt be produced in this way.—*Chymical News.*

121. *A Biographical Pastime.*

Every word printed in* ITALIC *to be substituted by the name of some eminent person.

One fine *afternoon* I started for a walk; my road at first lay between a *flowery* hedge and a winding *stream*. In the distance I heard the *wild* cries of a *beast* in a *hole*, probably dug to capture it, in preparation for a *chace*, and to prevent his attacks on the young *innocent* who gambolled near. I soon reached the *strand*, and while planning a *sail* for to-morrow, caught with the aid of my *stick* a *creature* of a *dun* colour, and with *hurried* steps took home my prize. The *servant* being absent I had to *dress* it on a *coal* fire, and in so doing inflicted two *injuries* on my hand, for which I found no consolation in 'poetry' or 'justice.' The dish proved so *scaly* as to be only enough for one *London magistrate*, and I had finished it before the arrival of some expected guests. The approach of the *merry* party was announced by the cheerful notes of my son's *flute*, and they soon began to enter the *vestibule*. One *juvenile* lady arrived in a *phaeton*, with her two namesakes, one of whom condescended to 'take the part' of driver. Next came an ex-governor,

looking very *severe*, and his daughter, Miss *Face*, partly enshrouded in a *covering* of *brilliant* blue, fastened at the throat by a *link* of gold. Some admired the mantle, others sneeringly remarked 'it must have been purchased at the *auction* rooms, it was so *tumbled*, and made her look quite a *slattern*.' A *foreign potentate* limped in with a *sweet bird* named after the fair Italian city which gave her birth. One gentleman was so late that a guest (*not English*) exclaimed '*Why* the *deuce* do we wait for him? He always calls himself a *great man*, but is certainly not above the *average*.' Sir *Robert Rind* and Miss *Pineapple* were the last to arrive, and by this time my *rooms* were so full, that I rejoiced that several friends had pleaded *previous* engagements.

For the key see p. 184. H. A. A.

122. *Melting Lead in a Paper Crucible.*

A neat experiment for boys, and one which gives a very impressive lesson in regard to the transmission of heat, is the melting of a bullet in the blaze of a lamp or of gas; the bullet being contained, at the time, in a wrapper of thin writing-paper. All that is requisite is to fold the paper tightly over the bullet, and rub down the folds very smoothly. It may then be held in the flame until the lead melts.

123. *Demonic Flames.*

In the caldron scene of Macbeth, in the 'Place of Skulls,' in 'Der Freitschutz' and other similar theatrical representations, excellent effects are produced by making fiery flames of various colours. This is done by dissolving in spirits of wine certain substances, for instance, bromide of copper produces blue flame, nitrate of strontian and chloride of calcium crimson and red flame, common salt a yellow flame, boracic acid and acetate of thallium a beautiful green flame.

In the pantomimes at the theatres we sometimes see 'flaming swords' used; these are prepared by wrapping list or flannel round a sword, and pouring on them spirit made in the above manner.

124. *To Balance a Shilling upon the Point of a Needle, and make it spin on its Edge.*

Take a wine bottle, and cork it well and firm; force the eye of a needle perpendicularly into the cork, leaving more than half the needle projecting up. Now take a good wine cork, and cut a slit in the centre of the bottom of it, into which place one edge of a shilling; then stick a fork slantways into each side of the cork; now with a steady hand place the shilling on the point of the

needle, and it will immediately find its balance; it may then be made to spin round as fast as you please, by giving the cork a twist with the finger and thumb.

125. *Fireside Mesmerism.*

Take a gold ring—the more massive the better—but your wife's wedding-ring will do, if you are so lucky as to have one. Attach the ring to a silk thread about twelve inches long; fasten the other end of the thread round the nail joint of your right fore-finger; and let the ring hang about half an inch above the surface of the table, on which you rest your elbow to steady your hand. Hold your finger horizontally, with the thumb thrown back as far as possible from the rest of the hand. If there be nothing on the table, the ring will soon become stationary. Then place some silver (say three half-crowns) immediately below it, when the ring will begin to oscillate backwards and forwards, to you and from you. Now bring your thumb in contact with your fore-finger (or else suspend the ring from your thumb), and the oscillations will become transverse to their former swing. Or this may be effected by making a lady take hold of your disengaged hand. When the transverse motion is fairly established, let a gentleman take hold of

the lady's disengaged hand, and the ring will change back to its former course. These effects are produced by the *Od* (or animal magnetic) currents given forth by the hands of the experimenters. Instead of silver, you can suspend the ring over your left fore-finger with similar results.

126. *Magic Milk.*

Lime water is quite transparent, and clear as common spring water, but if we breathe or blow

FIG. 21.

into it, the bright liquid becomes opalescent, and as white as milk. The best way to try this simple experiment, is to put some powdered quick-lime *into a wine bottle* full of cold water; shake them

well together now and then for a day; then allow the bottle to remain quiet till the next day, when the clear lime-water may be poured off from the sediment. Now fill a wine-glass or tumbler with the lime-water thus made, and blow through the liquid with a glass tube, a piece of new tobacco-pipe, or a clean straw, and in the course of a minute or so, as the magicians say, 'the water will be turned into milk.' By means of this *pastime*, 'Wise Men' can ascertain which young ladies are in love and which young gentlemen are not. With a shrewd guess, they present as a test a glass of lime-water to the one, and of pure water to the other, with unerring effect.

127. *The Best Card Trick Known. To tell the whole pack of Cards, with the backs towards you: also to sort them, after being cut any number of times, in the mere act of dealing them out in a row.*

This, undoubtedly, is one of the best illusions performed with cards, as it not only brings the whole pack into use, but is also legitimately founded upon arithmetical principles. It is performed thus:—

A pack of cards being distributed on a table, with their faces uppermost, they are picked up one by one in the following order:—6, 4, 1, 7,

5, king, 8, 10, 3, knave, 9, 2, queen. Repeat the same series for every thirteen cards; four times over will, of course, complete the pack.

That the above order may be remembered, the following words are used as a guide to the memory, and which are intended to enumerate the cards:—

6 4 1 7
The sixty-fourth regiment beats the seventy
5 *king* 8 10
fifth; up starts the king, with eight thousand
3 *knave* 9 2 *queen*
and three men and ninety-two women.

Hence this trick is said to be done 'by words!'

The pack being arranged, may be handed to any of the company 'to cut,' with the proviso that this operation be done whist fashion; that is, by taking a portion of the cards off in a mass, and placing the lower division on what was before the upper one. This done fairly and properly may be repeated any number of times, as the audience may think fit. You then take the pack, and by a feint catch sight of the bottom card; having learned this (and it may be done at a glance, in a second of time), you have the key to the whole trick. Then commence it by dealing the cards out in the ordinary way, but in thirteen heaps. Having dealt out thirteen, begin again and cover them; then go on as before; when *finished, there* will be, of course, four in each

heap. Now every heap will contain all four of the same denomination, as the four knaves in one heap, the four sevens in another, and so on. The thirteenth, or last heap, will be of the same denomination as the one at the bottom which you have contrived to see, and according to whatever that card is, all the suits will follow, but in the reverse order, as the words above indicate; thus —suppose the EIGHT was the bottom card, then on dealing them out they would be in the following order:—King, 5, 7, 1, 4, 6, queen, 2, 9, knave, 3, 10, 8; and you *begin* reciting in the mind the words you use *from* that passage in the sentence, working from right to left, which the card indicates in the above; you would say—

8 10 3 *knave* 9 2

Eight thousand and three men and ninety-two

queen 6 4 1 7

women; sixty-fourth regiment beats the seventy-

5 *king*

fifth; up starts the king with, &c. Here, of course, is your starting point.

The same principle holds good whatever the card may be. Any person asking for a card, all four of every suit may be found in the same heap, and can be quickly turned up as soon as required, with a little practice, to the utter astonishment and wonder of the company.

By taking up the cards in the same order as before, but *all of one* suit, you may easily

discover the position of any one card that is demanded.

128. *To prove that Air contains Water.*

However dry the atmosphere may appear to be, it yet contains a considerable portion of moisture; this is rendered evident by the following simple experiment. Put an ounce of dry chloride of calcium, or of acetate of potash, into a wide-mouthed bottle; weigh it with the bottle when the experiment is begun; leave the cork out, and place it in any situation free from dust; in three days or a week again weigh the bottle and its contents, a very perceptible increase in weight will then be discovered, which is entirely owing to the water that the substance employed has absorbed from the atmosphere. A great many chemical substances have this property, such as sulphuric acid (strong oil of vitriol), subcarbonate of potash, and even chloride of sodium (common table salt), but in different degrees. All materials having this quality are said to be 'deliquescent,' that is water attractive.

129. *Singular Effect of Tears.*

First peruse the 'Random Readings' of the 'Family Herald;' having 'laughed till you cry,' *let some of the* tears fall upon paper stained with

the juice of either Mallows or Violets, and they will change the bluish tint of the paper to a permanent green. 'Crocodile's tears' answer equally as well.

130. *The Christmas Tree.*

If you wish to amuse your friends, or 'a young party,' one of the best ways is to provide a Christmas tree; there being no art or mystery in their construction, we can set to work and make one easily enough. First provide a young fir tree, capable of being planted in a good sized flower-pot. This being done, set it upon a box or anything else that will give elevation so as to form a pedestal. The pedestal and pot must be decorated with leaves of the season, and the mould covered with moss, so as to give everything a neat appearance. At each branch or prong of the tree, a small wax taper is to be fixed upright; these tapers should be of as many colours as you can get. Suspended to each branch and at every point that is accessible, we are to hang anything and everything that we consider will please our party. Toys for children, sweets for youth, love mottoes and kisses for our 'third age,' and a few crackers for 'the fun of the thing.' When the 'company comes,' the tapers are to be lighted, and preparations made for the fair distribution of the good things 'growing' on the tree, taking care that there is sufficient 'fruit' for all visitors.

A kind of lottery or wheel of fortune is made by numbering a quantity of cards to match your company, they being put into a basket or reticule. Each person is to dip a hand into 'the lucky bag' and withdraw one card. According to the number upon it the rotation of choice from the tree is decided. This plan gives general satisfaction, and few leave your house but will remember in after years your Christmas tree.

Christmas trees had their origin in Germany (the country of Frobel). The author has good reason to believe that the first exhibited in this country was constructed by him for the amiable Mrs. Abel Smith, at the family seat, near Ware, in Hertfordshire, just twenty-five years ago, and from that type he has had the pleasure of seeing 'Christmas trees' became an annual household ornament—diffusing 'mirth and jollity'—in the homes of 'Merrie England.'

131. *To Place Water in a Drinking Glass ndsıpə pomu·*

Experiments of this kind are not only amusing but instructive; they illustrate what at first sight appears to be 'the laws of Nature reversed,' while in truth, when we are familiar with them, they teach the 'immutability of Nature's laws.' The more experiments a boy makes the greater number of rounds will he ascend up the 'Ladder *of Learning;*' and when he is at the top, how

bright is the prospect before him! All is beautiful, wonderful, and lovely. Then can he come down, and

> Find tongues in trees, books in the running brooks,
> Sermons in stones, and good in everything.

But to our paradox. Procure a plate, a tumbler, and a small piece of tissue or silver paper. Set the plate on a table, and pour water in it up to the first rim. Now very slightly crumple up the paper, and place it in the glass; then set it on fire. When it has burnt out, or rather just as the last flame disappears, turn the glass quickly upside down into the water. Astonishing! the water rushes with great violence into the glass! Now you are satisfied that water can be placed in a drinking glass ndsıpə pomu· Hold the glass firm, and the plate also. You can now reverse the position of the plate and glass, and thus convince the most sceptical of the truth of your pneumatic experiment. Instead of burning paper, a little brandy or spirits of wine can be ignited in the glass; the result of its combustion being invisible, the experiment is cleaner.

132. *Musical Flame.*

Fit a good cork into a wine-bottle; burn a hole through the cork with a round iron skewer, and into it fix a piece of tobacco-pipe about eight inches *long*. Put into the bottle about two or

three ounces of zinc, in slips, such as the waste cuttings from a zinc worker; now pour water on to the zinc until the bottle is rather more than half full; then add about three parts of a wine-glassful of sulphuric acid (oil of vitriol); this

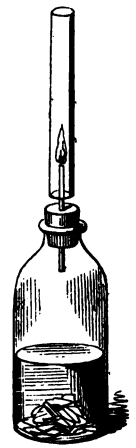


Fig. 22.

causes a rapid effervescence at first, but which subsides to a moderate and continuous boiling for a lengthened period; as soon as the boiling is regular the cork with the pipe through it may be inserted into the bottle. If a light be placed to the end of the pipe, a flame will be produced, which will continue to burn so long as there is any visible action in the bottle. This flame is the ignited hydrogen gas (water gas) resulting from the decomposition of water by the acid and

zinc, and as such is an exceedingly interesting experiment. Now, to be musical, procure a glass or metal pipe about sixteen or eighteen inches long, and from half to three quarters of an inch in diameter: place the tube over the flame, and allow the pipe to be about three to five inches up the tube, which will act as a kind of high chimney; it must be held perfectly steady and upright at a particular distance up the tube, which varies according to the size of the flame. A beautiful sound is thus produced similar to an organ pipe. This sound, or 'musical flame,' varies in note according to the diameter of the tube, being deeper or more bass as the tube is increased in size. By using various sized tubes, different sounds are thus readily produced. The true explanation of this singular experiment remains yet to be solved.

133. *To discover the Number of Pips on any three Cards which a Person has privately taken from the Pack.*

It is first to be agreed that the aces shall each count as eleven, the court cards as ten each, and the others according to their number of pips. Then desire any one to choose three cards out of the whole pack; and over each of them to put as many other cards as will make, with the number of its points, a total of 15; that is to say,

the bottom card to reckon for the number of pips thereon, and each additional card as one only. After this, take the remaining part of the pack in your own hand, and count how many cards there are remaining, when that amount, diminished by four, will be the number of points on the three bottom cards added together.

Example.—Suppose the person has chosen a seven, a ten, and an ace (eleven). Then over the seven he must place 8 cards; over the ten, 5: and over the ace, 4. After this, he gives you the remaining part of the pack, which you find consists of thirty-two cards. From this thirty-two, you deduct four, and the remainder, twenty-eight is the number of pips upon the bottom cards.

Or this trick may be performed by first discarding the four aces from the pack, which will supersede the necessity for deducting four from the cards that are returned to you, the number of cards remaining being exactly equal to the number of pips on the three cards first selected.

134. *All sorts of Colours.*

Some very interesting and beautiful experiments can be easily performed to illustrate the mode of making colours; indeed, many a young chymist in embryo has become a world-renowned philosopher from the desire to learn the cause of

the effects so singularly produced. In the following experiments all the substances named are solid salts, and it is necessary that they be first dissolved in pure water. When so dissolved the liquid is called a solution of such and such a material. Thus, if we take a solution of prussiate of potash, and mix it with a solution of sulphate of iron, both of which are nearly colourless liquids, a beautiful *blue* will be the resulting colour; exemplifying the method of making 'Prussian blue.' If, in the place of the sulphate of iron, we use a solution of nitrate of bismuth, then a *yellow* colour is the result; and if these are replaced with a solution of sulphate of copper, then a *brown* pigment is produced. Again, a solution of sulphate of copper and a solution of carbonate of soda produce an exquisite *green-blue* colour, the tint of which varies according to temperature, that is to say, whether the liquids, before they are mixed, be hot or cold. In this way carbonate of soda and acetate of lead produce a fine *white*; but with borax (in place of soda) a fine *yellow* is the result. A solution of nitrate of copper with one of arseniate of potash produces a fine *grass-green*. And thus different colours may be made, almost without limit, varying with the salts of the metals employed.

135. *The Real Will-o'-th'-Wisp.*

Into a small retort place about an ounce of strong liquor of potash; that is, pure potash dissolved in water, together with about a drachm of phosphorus. Let the neck or beak of the retort dip into a saucer of water, say half an inch deep; now very gently heat the liquid in the retort with a spirit lamp until it boils. In a few minutes the retort will be filled with a white cloud, then

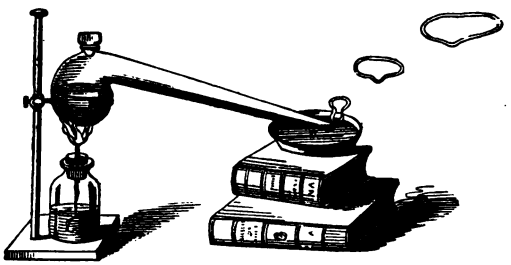


Fig. 23.

the gas generated will begin to bubble at the end of the saucer; a minute more, each bubble as it issues from the boiling fluid will *spontaneously take fire* as it comes into the air, forming at the same time the philosopher's ring of phosphoric acid. Care is required in handling phosphorus; but our young chymical readers will, we think, not forego this wonderful experiment for the want of due attention, for, without proper care on their part, we must give up showing them wonders, even greater than these.

136. *To cause Water to roll over Paper without wetting it.*

Take a sheet of writing-paper, and dust it over with the powder of lycopodium; if water is then let fall upon it, in very gentle streams, it will instantly form itself into little round balls, which will roll over the paper with uncommon rapidity, and without breaking, producing a very singular and curious effect. The same thing may sometimes be seen when water is sprinkled over a dusty floor. This phenomenon is accounted for from the fact that the attraction of the particles of water for each other is stronger than the attraction existing between the dust and the fluid, the atoms of which, being free to move over each other, assume a spherical form, according to the universal law of gravity.

137. *Magic Money.*

This conjuring trick is performed thus:—Procure two shillings and a sovereign; conceal one of the shillings in the *right* hand; lay the other shilling and the sovereign on the table, in full view of the audience; now ask for two handkerchiefs; then take the sovereign up, and pretend to roll it in one of the handkerchiefs; but, in lieu thereof, roll up the shilling, which you had concealed, and retain the sovereign,

give the handkerchief to one of the company to hold; now take the shilling off the table, and pretend to roll that up in the second handkerchief; but put up the sovereign instead; give this handkerchief to another person, and beg him to 'hold it tight,' while you utter 'Presto! fly!' On opening the handkerchiefs the money will appear to have changed places.

138. *The Ring Suspended by a Burnt Thread.*

Put a teaspoonful of salt in a wineglassful of water; stir it up and place in it some coarse cotton, such as Mamma calls No. 16; in about an hour take out the thread and dry it. Tie a piece of this prepared cotton to a small ring, about the size of a wedding-ring; hold it up, and set fire to the thread; when it has burnt out the ring will not fall, but remain suspended, to the astonishment of all beholders. Philosophers account for this effect by stating that the salt in the thread forms, with the ashes of the cotton, a fine film of glass, which is strong enough to support the ring or any other small weight.

139. *Magical Square Problem.*

An innkeeper had nine guests, four ladies and five gentlemen. Upon making enquiry he found that their respective ages added together amounted

to 342 years, and that the ladies, individually were younger than any of the gentlemen. The youngest gentleman asked Mr. Boniface how old he was? He replied that he could form a square with the nine persons present, by placing them in three rows thus:—

* * *
* * *
* * *

and that the united ages of the three persons in each of the different ranks, or diagonally, would be his age and the age of the gentleman who had put the question added together. Also, by omitting the youngest gentleman he could give each lady a partner, and the age of each couple, added together would be his age.—What was the innkeeper's age? The age of the youngest gentleman and the place he stood in the square? And the individual ages of each lady and gentleman forming a couple? For solution see p. 262.

140. *To put a Lighted Candle under Water without extinguishing it.*

Procure a good-sized cork or bung; upon this place a small lighted taper; then set it afloat in a pail of water. Now, with a steady hand invert a large drinking-glass over the light, and push it carefully down into the water. The glass being

full of air, prevents the water entering it. You may thus see the taper burn *under* water, and bring it up again to the surface still alight. This experiment, simple as it is, serves to elucidate that useful contrivance called the diving-bell, being performed on the same principle.

The largest drinking-glass holds but half a pint, so that your diving-light soon goes out for the want of air. As an average, a burning candle consumes as much air as a man, and he requires

Fig. 24.

nearly a gallon of air every minute, so that according to the size of the glass over the flame you can calculate how many seconds it will remain alight; of course a large flame requires more air than a small one. For this and several other experiments a quart bell-glass is very useful, but being expensive they are not found in every parlour laboratory; one is, however, easily *made from* a green glass pickle bottle: get a

glazier to cut off the bottom, and you have a bell-glass that Faraday would not reject.

141. *Curious Motions.*

Procure a basin of milk-warm water, throw into it half-a-dozen pieces of camphor about the size of a pea; in a minute they will begin to move, and acquire a rotary and progressive motion, which will continue for a considerable time. If now, one drop of oil of turpentine, or sweet oil, or even of gin (if allowed on the premises), be let fall upon the water, the pieces of camphor will dart away, and be deprived of their motion and vivacity. Little pieces of cork, that have been soaked in ether, act much in the same way as camphor, when thrown upon water.

Camphor, being highly combustible, will burn if ignited while floating upon water, producing a singular effect, reminding one of the lamps which the Hindoo maidens cast upon the waters of the Ganges as mystic messengers to their distant lovers, or to their spirits after death.

142. *A Leviathan Calculation.*

If one pin was dropped in the hold of the Great Eastern, the first week, two the next, four the next, eight the next, and so on, doubling the number each time for a year, 52 weeks, the number of *pins deposited* would be 4,503,599,627,370,495.

the weight of them, allowing 200 pins to the ounce, would be 628,292,358 tons; and the number of ships of the tonnage of 22,500 tons each, same as the Great Eastern, required to carry them would be 27,924.

143. *Wiljalba Frikell's Obedient Watch.*

At the festive season, when red fire and blue flame add their charm to the pantomime—when the young folks are to have 'their party'—when everything that is beautiful, that is lovely, that is charming to our five senses, is purposely gathered together to captivate the mind, and make it love life—when the EYE is gratified with the angelic forms that flutter in the ball-room —(the personification of a happy youthful dream)—when the OLFACTORY nerve vibrates with sweet smells—when the EAR carries the sounds of music that plays upon the heart's strings a joyful tune—when TASTE pronounces blanc-mange, custard cream, and frangipane pudding the acme of what is good—and when TOUCH, by the clasping hands and kissing lips, tells us that they whom we have expected for a 'whole year' have at length arrived—when all these, the five acts of our Christmas drama, are enacted in one scene, and that scene happens to be in our own drawing-room (Leisure Cottage, Chiswick), we of course must play *our* part. *The twelfth* cake on the sideboard prophetically

tells us we must soon 'choose our character.' Our part is that of a MAGICIAN. We borrow a gentleman's watch. Does it go well? Yes! tic, tic, tic—tic, tic, tic. Does it go now? No!—see, the second-hand is motionless! Well does it go now? Yes!—again we hear the familiar tic, tic, tic. How is this? What an obedient watch! Now as it is the holidays, I'll tell you how this watch was made 'obedient.' When you show this trick you must wear a pair of well-fitting kid gloves. In the palm of your right hand you conceal a small magnet under the glove. In your right hand the watch stops from the action of the magnet on the balance-wheel; in your left hand it continues to indicate the time as usual. Thus, changing the watch from hand to hand, you make it 'obedient.'

144. *The Gong Poker.*

Tie a piece of string, about the substance of whipcord, round the handle of a poker, leaving the two ends about a foot long. Now take the ends of the cord, and pass them one over each ball of the thumb, so that the poker can be lifted up and suspended between the hands. In this position, place the thumbs and ends of the cord as close into each ear as convenient. If now a second person strike the poker, the one who holds it will hear a sound very surprising when experienced

for the first time, but scarcely audible to the striker. If the blow be a sharp one, and struck with a hard body, as the back of a knife, the sound will be as strong as the deepest note of a piano, and if struck a hard blow with a hammer the sound will appear as powerful and booming as a cathedral bell. If the experiment be made

FIG. 25.

with a large kitchen poker, then the sound is 'stunning,' and equals anything that can vibrate from Big Ben.

145. *The Inexhaustible Bottle Trick explained.*

Some of the illusions performed at the theatres *are of a very* complicated character, and more

than one *ruse* has to be contrived to mislead, or rather to lead, the audience to think differently to what they intend. Tricks within tricks, 'Veels vithin veels,' as the shrewd Sam Weller says, are worked to render perfect one deception, and thus it is with the bottle trick. 'Wherever does it all come from?' says Mrs. Partington. My dear madam, that's where it is; you are deceived in the least deceptive part of the trick. There is a good deal of deception, certainly, but not more than one-half of what you fancy. In the first place, there are the wine-glasses; supposing them to be filled, they will not contain more than one quarter of the quantity of the usual glass; they are in fact what I heard Mrs. Thingamy (our charwoman) say were regular 'eight-outs,' that is, a quartern, or gill, will fill eight of such glasses. Let me see, a wine bottle holds nearly eight quarterns; eight times eight (for such are the glasses used at the theatres) are sixty-four. No wonder poor Mrs. P. should say 'Where does it all come from?' when she sees five dozen and four glasses filled from one bottle; no wonder that the bottle is christened 'Inexhaustible.' Secondly, suppose I have a bottle to hold a quarter more than an ordinary bottle; by having it made a trifle larger in diameter, and doing away with the false bottom which exists in all common bottles, why then I could contrive it to hold no less than eighty of the wizard's 'bumpers!' Fancy a conjuror

having what a wine merchant has not—an honest bottle! You won't believe it? Well, then, here you are deceived again, for it is an honest bottle that is used. Now for the trick. An empty bottle is brought forward (*the* bottle); it is washed out before the company, and drained, to show that it is both clean and empty; but it wants wiping (of course!) after being wetted. So a napkin is handed to the magician, with which he wipes the bottle, as much after the fashion of a waiter as he can; but in this clumsy kind of napkin is concealed a weak preparation of spirits of wine, sugar, and water, in a bladder; and thus, in the face of the audience, he fills the bottle without their knowing it. Now to account for the *different* liqueurs. This part of the illusion is thus managed. The glasses are arranged on the tray, in a definite manner, known to the operator; into each glass one drop of various flavouring essences is placed, such as essence of noyeau, essence of brandy, essences of port or sherry wine, lemonade, peppermint, cloves, pine-apple, pears, &c.; these being filled up with the spirits of wine, according to what is called for by the audience, completes the illusion of the inexhaustible bottle. And if still more be required, the operator may have concealed in his sleeve a bladder of liquid, as easily as a bagpipe-player can stow away a bag of wind.

146. *The Wizard's Chain.*

The very effective illusion of linking and unlinking a set of solid rings, so as to form a chain of various devices, has been exhibited by 'wise men' from a very remote period even to this day. This trick is publicly played off at our country fairs and in the streets, with as much *éclat* as ever. The conjuror begins the trick by bringing forward seven rings, formed of either stout iron or brass wire, and about ten or twelve inches in diameter. Three of these rings are permanently linked by the maker; two others are permanently

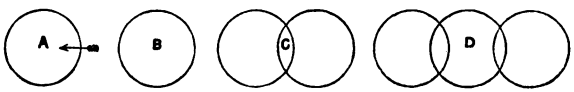


FIG. 26.

linked; then one solid ring (B), and one (A) left unsoldered, making seven in all. When held up together they appear to be separate. The rings marked B, C, and D, are placed upon the ground, while A is held in the *left* hand, the joint (indicated by the arrow) being concealed with the forefinger and thumb. B is now picked up, and is readily linked on to A; the same is done with C, and then with D. The least practice will show that various devices can be formed, according to what ring of the set is put on to A. During the trick it is well to give B or C now and then for the company to examine, and as they

are unable to find any opening, their surprise is increased, especially if you say that it would be useless to put you into prison in chains, as you would soon get out. The nature of the trick being known, the performer is not confined to any particular number of rings, but may employ as many as he can expertly handle.

Key to the Biographical Pastime, p. 156.

Day. Hawthorn. Brook. Savage. Fox. Pitt. Hunt. Lamb. Shore. Rowe. Kane. Crabbe. Gray. Swift. Cooke. Boyle. Coke. Burns. Shelly. Selfe. Gay. Horne. Hall. Younge. Brougham. Sterne. Head. Hood. Bright. Hook. Sale. Creasey. Trollope. Pope. Nightingale. Scott. Watt. Dickens. Longfellow. Parr. Peel. Mellon. Chambers. Prior.

147. *Secret Letter writing.*

The art of transmitting secret intelligence is as old as the art of writing itself. In the time of war it has been of great service in all countries. Various and ingenious plans have been adopted to this end. The following plan is simple, and may amuse when we are in the 'itch for writing;' it is called 'corresponding spaces.' Take two pieces of card-board, or stiff paper, through *which cut* oblong squares at different distances,

as in the example below: one of these pieces you keep, and the other is to be given to your correspondent. When any secret intelligence is to be sent you lay the card-board upon a paper of the same size, and *in the spaces* you write whatever you would have understood, and then fill up the intermediate space with somewhat that makes with those words a different sense, thus: —

[I shall be] much obliged to you, as reading [alone] engages my attention [at] present, if you will lend me any one of the [nine] volumes of the *Family Herald.* I trust that you will excuse [this] freedom, but for a winter's [evening] I [don't] know a better entertainment. If I [fail] to return it soon never trust me for the time [to come.]

So that, if you possess the cut piece of card-board, the only words visible are:—'I shall be alone at nine this evening. Don't fail to come.'

148. *The Æolian Harp.*

During the summer season many persons might enjoy the melancholy music of this instrument; we therefore give the following directions for its construction: — It consists of a long narrow box of very thin wood, about six inches deep, with a circle in the middle of the upper side, of an inch and a half in diameter, in which are to be drilled small holes. On this side, seven, ten, or more strings of very fine catgut are stretched over

bridges at each end, like the bridge of a fiddle, and screwed up or relaxed with screw pins. The strings must all be tuned to one and the same note (D is perhaps the best), and the instrument should be placed in a window partly open, in which the width is exactly equal to the length of the harp, with the sash just raised to give the air admission. When the air blows upon these strings with different degrees of force it will excite different tones of sound. Sometimes the blast brings out all the tones in full concert, and sometimes it sinks them to the softest murmurs. A colossal instrument of this description was invented at Milan in 1786, by the Abbé Gattoni. He stretched seven strong iron wires, tuned to the notes of the gamut, from the top of a tower sixty feet high to the house of a Signor Moscate, who was interested in the success of the experiment; and this apparatus, called the 'giant's harp," in blowing weather yielded lengthened peals of harmonious music. In a storm this music was sometimes heard at the distance of several miles.

149. *Instantaneous Crystallisation.*

All experiments for the production of crystals are both interesting and beautiful; they show that all matter will assume, under favourable circumstances, a definite and regular form or shape.

Crystallisation is a species of vitality belonging to, and inherent in, what are generally called earthy substances, perfectly analogous to the regular form assumed by plants and animals. A certain crystal will produce crystals of a like kind (see the experiment 'The seed of crystallisation'), but not of another; just as the seed of one plant produces its kind, but no other. Crystallisation is the first link of the chain that unites man with the 'dust of the earth.' The slower crystals are formed, the more beautiful and regular they appear; but as it is interesting to see them form quickly, though not of good shape, we give the following experiment, by which a liquid is made to become almost solid in an instant. Take half a pound of Glauber salts (sulphate of soda), crush it to powder, and pour upon it half a pint of boiling water: as soon as the salt is dissolved, pour off the clear hot liquor into a warm glass tumbler, and set it in an undisturbed place; now, as quickly as you can, put a tablespoonful of sweet oil on the surface of the solution, and let it stand till quite cold. In this state it will remain liquid; but if touched with a piece of wood, or if anything be dropped into the glass, the whole will instantaneously crystallise. If a bottle be quite filled with the hot solution, and corked up while hot, it will remain liquid when it becomes cold; but when the cork is drawn, crystals will be *rapidly* formed.

150. *Acoustic or Sound Figures.*

If we strew fine sand or lycopodium powder upon a stretched membrane, and very near it play upon a flute, violin, or pianoforte, the sand will arrange itself into certain definite and beautiful figures, which perpetually change with the sound produced. To make the experiment, we must stretch a thin piece of damp parchment or paper (tissue or rice paper answers the best) over the mouth of a glass tumbler, having a footstalk, and fix it to the edges with paste or thin glue. When the paper is dry, a thin layer of sand is strewed upon its surface; then, if any sound be produced near to it, the sand will assume the most curious arrangements. If no musical instrument is at hand, a bell will answer every purpose, or a tumbler, striking it with a cork fixed on a piece of whalebone or cane. When the same figure is produced several times in succession, a breath upon the paper will alter its tension, and cause entirely new forms to be developed. If a round or square plate of glass be held firm at any of its parts with a clamp (a lady's table screw-pincushion will do), sand that is strewed upon it will assume geometrical figures, by drawing a fiddle-bow across the edge, and according to the distance from the fixing point so will the figures be. Parchment is only suitable for large surfaces, at *least a foot* in diameter. A child's drum will

answer the purpose, when the sound is loud and powerful.

151. *The Wine-Merchant and his Clerk.*

A wine merchant caused 32 casks of choice wine to be deposited in his cellar, giving orders to his clerk to arrange them, as in the annexed figure,

1 7 1
7 7
1 7 1

so that each external row should count nine, saying that they must be all right if he could count nine in each row. The clerk, however, took away 12 of them, at three different times—that is, 4 at each time; yet when the merchant went into the cellar, after each theft had been committed, the clerk always enabled the merchant to count nine in each row.

The cunning rogue practised this deception by the following stratagem:—

2nd Order.	3rd Order.	4th Order.
2 5 2	3 3 3	4 1 4
5 5	3 3	1 1
2 5 2	3 3 3	4 1 4
4 absent.	4 more absent.	4 more absent.

152. *Imitation of Hoar Frost.*

There is a substance sold by druggists, called *flowers of benzoin*; when heated, it rises in fumes

imparting to the atmosphere of a room a most delightful odour, resembling sweet incense, which, in fact, it is: if the vapour be collected, it will crystallise upon any cold object that it touches like the 'spangled hoar frost.' For our experiment, support a small plate upon the edges of three wine glasses, and set a piece of wax candle burning beneath it: this will soon make the plate hot: now place on it about a teaspoonful of the flowers of benzoin: as soon as the least vapour rises, invert over it a large glass, or tumbler, containing a sprig of any evergreen, such as holly or rosemary; the small-leafed shrubs answer the best; when the glass appears full of smoke, the heat must be stopped, and the whole allowed to cool undisturbed; when cold, the interior of the glass, and the sprig (or other object that has been placed under it) will be found covered with the beautifully sublimed crystals of benzoic acid.

153. *To eat a Peck of Paper Shavings, and convert them into Ribbon.*

Shouts of laughter generally arise from the *audience* while the magician 'stows away' down *his bottomless* throat the heaps of paper before *him*; but when he 'brings up' yards upon *yards of ribbon*, as a proof of bad digestion, the 'splitting sides burst with applause.' This, like *all the best illusions*, is exceedingly simple; but,

to carry it off well, requires a little gesticulation and comic spirit in the Illusionist. Procure fifteen separate yards of different coloured ribbon, of that width as is sold at a penny a yard; sew them together to form one length, joining the contrasting colours; then roll it up neatly round itself, and it will be about the size of four half-crowns put together. Now obtain two penny-worth of white paper shavings, from a book-binder; shake them up lightly, and they will look like a bushel. When you begin the trick, take the roll of ribbon in the left hand, which with a few shavings is effectually hidden, then 'set to' and eat your paper; as you feed, by pretending to thrust an extra handful down the throat from time to time, you can easily manage to withdraw the masticated portions unseen and carry them down to the ground, as you lift other 'tit bits' to the mouth. After this has continued long enough, that is, when your visitors have laughed 'till their sides ache,' the shavings are now and then pressed up, which gives the appearance of diminished quantity; finally a last effort is made 'to finish it,' and then you pop the roll of ribbon in the mouth, and throwing the remaining shavings on the floor you take hold of the end of the ribbon, and begin to unwind it; by drawing it gradually from the mouth it will appear as though it came from the stomach; the teeth must be kept close enough to

prevent the entire roll from being pulled out altogether. When cleverly performed, this trick is one of the best pieces of fun which the magician exhibits.

154. *To copy Impressions.*

To take an exact mould of any coin, medal, embossed or stamped paper, or, in fact, of any devise, raised or imprinted (that is, sunk on paper), cut a piece of cardboard, say to the breadth of half an inch, with which form a ring just the dimension of the impression to be taken; then pour within the said ring, which surrounds the spot, melted fusible metal; the carding will prevent the metal from running away, and in a few minutes it will be cool and take the impression, without the slightest injury to the paper from which it was taken. The impression, &c., taken will be the same as the original, but reversed. Fusible metal is a compound of eight parts of bismuth, five of lead, and three of tin, which liquefies at 212°, or the same temperature as boiling water, and below that if one part of quicksilver be added.

155. *To Light a Candle without touching the Wick.*

Let a candle burn until it has a good long snuff, then blow it out with a sudden puff, a bright *wreath of white* smoke will curl up from the hot

wick; now, if a flame be applied to this smoke, even at a distance of two or three inches from the candle, the flame will run down the smoke and

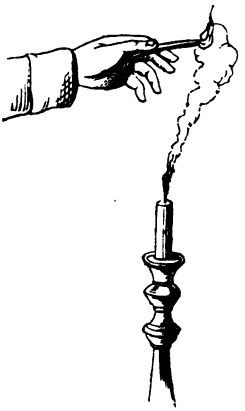


Fig. 27.

rekindle the wick in a very fantastic manner. To perform this experiment nicely, there must be no draught or 'banging' doors while the mystic spell is rising.

156. *To raise Fire by Command.*

A vessel containing a certain white powder is placed upon the table by the wizard — the man who is held in great awe by the juveniles on account of his seeming supernatural powers, and yet beloved by them because he affords them *much pleasure* by the exhibition of his talent, to

say nothing of the bon-bons, apples, oranges, almonds, and sugar-plums, which he causes to issue from an apparently empty drawer, or handkerchief, and upon which they are allowed to feast. This said wizard, having placed the above-mentioned powder on the table, now advances, waving his wand and uttering the magic words, '*Cassafelto, presto, aldiborontiphoskiphorniostiicos*,' when lo! of a sudden the room is lit up with a brilliant light, so effulgent that it dims the eyes of the spectators! The secret is this: — The powder is composed of equal weights of loaf-sugar and chlorate of potash, separately reduced to fine powder and then well mixed together. This is placed in some vessel, such as a cup, or in fact anything that will prevent the fire from injuring the table. When this powder is touched with the least drop of sulphuric acid, it will instantly burst into a flame; if, therefore, the end of the glass rod be dipped in the acid immediately before use, it will, on being brought into contact with the deflagrating powder, cause it to ignite.

157. *Hearing with the Teeth.*

That faculty which we call 'hearing,' can be as well conveyed to the mind by means of the teeth as the ear. Curious as this assertion may appear, it is easy to prove it by the following simple experiment. Lay a watch upon a table, glass side

downwards; then stand so far from it that you cannot in the ordinary way hear the ticking. Now place one end of a small deal stick (say six feet long) upon the back of the watch, and grip the teeth to the other; with the fingers close each ear, to exclude all external noise; the beat of the watch will then be as audible as if placed against the ear. All other sounds can be conveyed in the

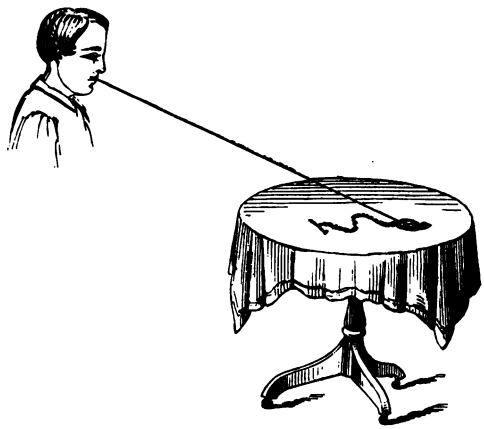


FIG. 28.

same manner, no matter how long the stick is; for instance, if one end is put upon a pianoforte in a sitting-room facing a garden, and the stick is thirty or forty feet long, extending to the farther end of the lawn or walk, if the instrument is ever so lightly played, 'the tune' will be instantly distinguished by any person applying the teeth *to the opposite* end of the stick. See Fig. 28.

158. *To stand an Egg upright.*

The unceremonious manner in which the Great Navigator performed this feat, by breaking one end, is familiar to all who have read the anecdote of 'Columbus and the Egg.' Evidently at that time it was considered *impossible* to stand an egg on its point. Such, however, is not the case. By taking an egg (a long one is the best), and well shaking it, so that the yolk may be broken and mixed with the white, it can be balanced, by any one with a 'steady hand,' upon its broad end. A piece of glass, or slate, or any smooth and even surface, is best adapted for this experiment, called the Sentinel Egg.

159. *To pass Six Halfpence through a Table.*

When this trick is well done it is one of the best 'table moves' that can be shown for the amusement of 'a small party.' Rivet six halfpence together by passing a copper wire through them. In this condition, when placed upon a table, they appear to be only a few coppers piled in a heap, and no person will have any suspicion of their being fastened together. Now make a little card tube, about two inches long, and just large enough to slip easily over the halfpence; thus prepared, when you are about to 'show the *trick,' proceed* thus. Take the riveted halfpence

in the *left* hand, and the tube, or cap, as the conjurers call it, in the *right* hand. Advancing to the company, show them the cap to see that 'all's fair,' explaining at the same time what you are about to do. On receiving back the cap, place it over the half-pence in the left hand. Now borrow the money required from the audience, and exhibit it upon the table; then take with your *right* hand the cap, and with a little pressure the riveted halfpence with it, and place it upon the table. Now, with the left hand pick up 'the browns,' and put them under the table with a jingle, and 'Presto!' command them to pass! Then gently lifting up the cap, the company see your halfpence upon the table, which they mistake for their own. The trick is completed by repassing the money through the table in a similar way; that is, by placing the cap again over the halfpence and pressing it; thus removing the riveted money without suspicion, especially if you immediately direct the audience to examine the table and see that you have not injured it by your 'electrical experiment.'

160. *Houdin's Ink and Fish Trick explained.*

This illusion, which was the cause of so much wonderment to the audience at the St. James's Theatre, is thus performed. A large goblet is produced, capable of containing two quarts,

apparently full of ink. A small quantity of the ink is taken out with a ladle, and being poured on to a white plate is handed round to the company, thus satisfying them of its inky nature. A cambric handkerchief is then covered over the goblet, and and being instantly withdrawn reveals the glass now full of water, in which swim gold and silver fish. The trick rests—first, with the goblet,

Fig. 29.

which in reality has a black silk lining kept in its place by a wire ring; and is, as it were, a bag without a bottom, fitting close (when wet) to the sides of the glass: in it is placed the water and fish. The second part lies with the ladle, which has a hollow handle, capable of containing enough ink to induce the audience to think that it was got from the large glass before them; as the ladle lies on the table, the ink remains in the *handle; but*, when elevated, it runs by a small

aperture into the bowl, and being instantly poured on the plate, misleads the sense of vision. The final part of the trick is placing the handkerchief over the glass. The operator can withdraw the black silk lining unobserved with his finger and thumb at the same time that he removes the handkerchief, in the folds of which the silk is hidden. The audience are now sufficiently diverted with the fish to enable the operator to conceal the handkerchief, &c.

161. *Curious Phosphoric Experiment.*

Procure a clean oil flask, and fill it about three parts with water; now drop in half a drachm (one sixteenth of an ounce) of phosphorus; then hang up the bottle in such a manner that you can place a lighted lamp under it. As soon as the water is warm, streams of fire will dart from the bottom of the water, resembling sky-rockets; some particles will adhere to the sides of the glass representing stars, and will display brilliant rays. These appearances will continue till the water begins to simmer, when immediately a beautiful aurora borealis begins, and gradually ascends till it collects to a pointed flame; then blow out the lamp, and the point formed will rush down, forming beautiful clouds of fire, rolling over each other for some time; and as these disappear, a beautiful hemisphere of stars presents itself. After waiting a minute or two, light the lamp again, and the

same will be repeated. The stars may be increased by alternately lighting and blowing out the lamp several times consecutively. The liquid in the flask will allow of several repetitions of the experiment.

162. *Curious Multiplication.*

By Eleven.—Add together its two extremes, and place the sum between them. Ex. $36 \times 11 = 3(9)6$ —(three hundred and ninety-six)—the figure included by brackets being the sum of 3 and 6.

163. *The Game of Shadow Buff.*

The old English game of blindman's buff is so well known, that the mere mention of its name will be sufficient to convince our readers that it is the origin of Shadow Buff, much played on the Continent; and from the fun it affords, well worthy of taking a prominent place among our family Christmas sports. The game is played as follows:—First of all we hang up a sheet or table-cloth against the wall, whereon to 'cast the shadow.' In front of the sheet, and eight or ten feet from it, we are to place a lamp or one good light upon a table, in order that the shadow or profile of any person standing between the light and sheet may fall thereon. The company being assembled, 'Buff' is chosen either by vote or lot, or is peradventure a volunteer. Buff has now to sit upon a

very low stool about four or five feet from the wall, and look steadfastly for the 'coming shadow.' The merry company now pass in procession between the light upon the table and Buff, who forfeits if he turns his head in the least degree. As the profiles pass before him, he must name successively the person to whom the image belongs. The mistakes he makes occasion much merriment, especially if each person whose turn it is to 'cast a shadow' endeavours in every way to disguise his identity; by stooping if tall, tip-toeing if short, by grimace or contortion; putting on a long mask nose, and doing other funny things. However, as some persons invariably 'cast their shadows before,' Buff guesses right at last; and he who till now helped to make the fun must take his turn upon the stool to be made fun of.

The following excellent letter has been received by the author:—

SIR,—Our Christmas party were delighted with your excellent new game of Shadow Buff. The metropolitan and provincial press seemed equally pleased with it, for I observed that many appropriated it to their columns, although they did not mention its source. Now, sir, excellent as the game is, I have the presumption to improve it; for instance, when the sheet whereon to cast the shadow is hung up, instead of placing it against a wall (as you mention), allow me to suggest that it be suspended between folding-doors, or placed across a room, like a curtain, in order that Buff may be placed *behind the sheet*, instead of sitting in front. By this

means the company have a better chance of disguising themselves; and the task of naming the shadows is rendered a little more difficult, as Buff cannot then so well hear the rustling of silk dresses, &c., which materially aids him to guess 'Cousin Kate' from 'Uncle Harry,' though she has his coat on and he her mantle.

You spoke of 'artificial noses,' and as some of your readers may think of such things only in surgical cases, it may perhaps be as well to mention that such can be had, 'warranted to fit,' and in great variety, at most of the toy-shops—'Aquiline,' 'Roman,' 'Pug,' or 'Ruby.

Yours faithfully,

WILLIAM ALLEN.

LAITHFIELD HOUSE, SHEFFIELD.

164. *Rotatory Paradox. Exhibiting practically the interesting question of the Rotation of the Earth as rendered visible by the Pendulum.*

The following simple experiment illustrates completely the rotation of a table or plane placed on the surface of the earth:—Fill a small basin or cup nearly full with water, on which float a round piece of paper about the size of a crown piece, *the paper having a line ruled across it* to better indicate the result. Then place over the top of the cup a knitting needle, or any other straight body, in such a direction that when the cup is taken up by the hand it shall point to the person holding it. Now, let the person holding the cup in one or both hands turn round, or *revolve* on his own axis. The result will be

most striking, and the paper will evidently appear to turn round. What does all this show?

The person holding the cup represents the axis of the earth. The cup itself represents a table or plane on the earth's service; the needle represents the meridian of the same plane, constantly pointing to the pole of the earth's axis; whilst the piece of paper represents the pendulum. But the experimenter will probably say, the piece of paper evidently revolves, whilst the cup or table, with the meridian, remains stationary, or at least is constantly pointing in the same direction. *The paper or pendulum does not revolve in the sense imagined*: if it turned on its centre, the line ruled across it would not point constantly in the same direction, but would alternately point to every part of the room. Now, instead of taking the cup in the hand, and turning round with it, let it be turned round on its axis as it stands on the table. The paper will remain stationary, and the line drawn across it will constantly point in one direction. In the latter case there is nothing paradoxical; the cup is actually turned round, and the paper is fixed; but, as regards the motion of the paper on its centre, both cases are alike, the only difference being, that in the former the cup has two motions—one in a large circle or orbit, and the other on its centre, the paper partaking of the orbital motion only—*whilst in the latter* case the cup is made to turn on

its axis, whilst the paper remains stationary. But if it is not the paper or pendulum, it must be the needle and cup, representing a table placed on the surface of the earth, which revolves.

The *rationale* is simply this: The water in the cup being quite free, and almost without friction, remains stationary; consequently, the paper floating on its surface partakes of its immobility: the fact of the line across the paper being always in the same direction, or in planes parallel to each other, is evidence of this. What deviation takes place in the position of the paper arises from the friction between the water and the surface of the cup, which tends to give the water a circular motion with itself.

The foregoing experiment is not intended *strictly* to show the motion of a table placed at latitudes intermediate between the pole and the equator, it simply exhibits how a body revolving with the earth, like a pendulum, without friction, will *apparently* have a circular motion, whilst, in fact, it is the earth's surface which revolves, not only round the axis of the earth, but also round the axis of its own plane; and it is this latter revolution that gives the apparent circular motion to the pendulum.—W. L.—*Illustrated London News.*

165. *Which is the Boiled Egg?*

Boil an egg hard; when quite cold place it *among* a dozen, or any number of others, 'the

more the merrier.' Now ask your friends to tell you which is the boiled egg. This they will be unable to do from outward appearance; indeed, there is but one way to ascertain it with certainty, except that of 'peeping at the inside,' which is by spinning them. Those which are unboiled, and semi-liquid inside, will spin with a sort of waddling motion, while the boiled, or solid egg, will spin like a top, and even 'go to sleep.'

166. *Geometrical Progression.*

What would one hundred ships come to at one farthing for the first, two farthings for the second, four farthings for the third, and eight farthings for the fourth, and so on to the last; or just simply multiplying by two?

Answer.—557,750,707,053,344,041,463,074,442 18*s.* 7$\frac{3}{4}$*d.*

Which would run thus:—557 quadrillions, 750,707 trillions, 53,344 billions, 41,463 millions, 74,442 pounds, 18 shillings and seven-pence three farthings.

Now this amount of sovereigns, if weighed, would produce 3,557 trillions, 83,590 billions, 327,449, millions, 123,418 tons weight. And such a weight of gold would load one hundred thousand ships as large as the 'Great Britain,' of 3,000 tons; and not only once, but 11 billions, 523,611 millions, 967,758 times over, and then

we should have nearly 50 million tons left, so that the overplus would load 16,600 more ships like the above.

But I am still afraid that I have not brought it into the mind's eye as forcibly as I could wish. A better idea of the number of large ships may be formed when I say, that if they were put into a straight line a-head of each other, they would reach from Liverpool to New York and half-way back again; and all those ships loaded nearly twelve billions of times over, simply from the product of one hundred, at one farthing, two farthings, four farthings, and so on, is certainly very amazing. So much for simple progression.

167. *Eatable Candle-Ends.*

Take a large apple and cut out a few pieces in the shape of candle-ends, round at the bottom and flat at the top, in fact, as much like a piece of candle as possible. Now cut some slips from a sweet almond, as near as you can to resemble a wick, and stick them into the imitation candles. Light them for an instant to make the tops black, blow them out, and they are ready for the trick. One or two should be artfully placed in a snuffer-tray, or candle-stick; you then inform your friends that during your 'travels in the Russian Empire,' you learned, like the Russians, to be fond of candles; at the same time lighting your artificial

candles (the almonds will readily take fire and flame for a few seconds), pop them into your mouth, and swallow them one after the other.

168. *The Crowning Puzzle.*

First place ten draughtmen in a row, thus,

1, 2, 3, 4, 5, 6, 7, 8, 9, 10.

Now the difficulty is to lift a man up, and passing over *two* each time, and no more, to crown the next to them, continuing thus until they are all Kings. In passing over a King it is to be reckoned as two men; thus, for instance (not that this is any explanation of the puzzle—that is for our young friends to solve), suppose we place the 6th on the 3rd, it must pass over two men; and then the 4th on the 2nd, we pass a King (two men); here will be two crowns effected, but the puzzle completed must have five crowns and no men. Remember well, that it is required to pass over two, but never more nor less than that number.

Explanation. Place the 4th on the 1st, the 6th on the 9th, the 8th upon the 3rd, the 2nd on the 5th, and the 7th on the 10th.

169. *The Acrostic and Telestich.*

The word acrostic in its derivation includes various artificial arrangements of lines, and many *fantastic conceits* have been indulged in. Gene-

rally the acrostic has been formed of the first letters of each line; sometimes of the last; sometimes of both; sometimes it is to be read downwards, sometimes upwards. An ingenious variety, called the Telestich, is that in which the letters beginning the lines spell a word, while the letters ending the lines, when taken together, form a word of an opposite meaning, as in this instance, written by Louisa Sheridan, on hearing a friend say that the words *Unite* and *Untie* are composed of the same letters:—

U nite and untie are the same—so say yo U.
N ot in wedlock, I ween, has this unity bee N.
I n the drama of marriage each wandering *gou T*,
T o a new face would fly—all except you and I—
E ach seeking to alter the *spell* in their scen E.

170. *Three Liquors in One Glass.*

Make a strong syrup of white sugar in water; colour it, if you think proper, with a little burnt sugar, or it may remain bright. Into a tall champagne or ale glass pour some of this syrup, about one-third up. Now very carefully pour in some milk, as in the experiment with the magic egg; use a spoon to break its fall; the milk will then float upon the syrup. When this is done, proceed in the like manner, using port wine for the third liquid, which, in its turn, will float upon the milk.

Now you can undertake to drink either of the

two lowest liquids before the wine, which task would puzzle some people, but is, in fact, very easily managed. With the aid of a straw each liquid may be sucked up, as the Americans do 'sherry cobbler.' To give some magical effect to the performance, a fourth liquid may be added, namely pure rectified spirit; a tablespoonful is enough; which, being ignited, gives to the whole a singular and enchanted appearance.

For variety, the syrup can be used white or coloured: plain, or flavoured with essence of almond or lemon. Instead of milk, for the second stratum, use water, plain or flavoured; and, for the third stratum, take sherry wine in lieu of the port.

Several glasses thus prepared, and brought upon a tray into a room where there is company, will cause much amusement. A straw should be handed to the visitors with each glass.

171. *Boys' Marbles.*

There is something ingenious in the manufacture of these toys. The greater part of them are made of a hard stone found near Coburg, in Saxony. The stone is first broken with a hammer into small cubical fragments, and about 100 to 150 of these are ground at one time in a mill somewhat like a flour-mill. The lower stone, and which remains at rest, has several concentric

circular grooves or furrows; the upper stone is of the same diameter as the lower, and is made to revolve by water or other power. Minute streams of water are directed into the furrows of the lower stone. The pressure of the runner on the little pieces rolls them over in all directions, and in about one-quarter of an hour the whole of the rough fragments are reduced into nearly accurate spheres.

172. *To cover Lace or Net with Copper.*

This beautiful experiment can be performed by any person in possession of a simple galvanic battery. First make a saturated solution of sulphate of copper in a vessel large enough to contain the lace that is to be experimented upon fully stretched out. Next stretch the net or lace upon a copper ring; then dust it well over with the best black lead, using a camel-hair brush to rub it into every part. This black lead acts as a conductor to the electricity, when the net is attached to the battery. In fixing the apparatus, the ring and net are to be attached to the wire in connection with the zinc end of the battery, and then perfectly immersed in the copper solution. A piece of copper attached to the wire, in connection with the copper end of the battery must also be inserted in the decomposing vessel, facing the net, but not touching it; this not only acts

as a conductor but also maintains the solution of copper of a permanent strength. In a short time the copper will be found to creep over the whole surface of the net. If desired, it may afterwards be gilt or silvered by the same process, provided that gold or silver be substituted where copper was previously used. We have little doubt but that this 'experiment' will eventually be of the greatest service to commerce and the arts.

173. *The Galvanic Battery.*

If a piece of zinc be put into weak hydrochloric acid in water, it decomposes the acid. This acid is a compound of hydrogen gas and chlorine. When the zinc touches the acid, the chlorine, by its greater affinity for the zinc, leaves the hydrogen and unites with the metal; the hydrogen being then free, rises in bubbles through the liquid. If now we put into the same acid a piece of copper which has a wire fastened to it, and if with this wire we touch the zinc, then the experiment assumes quite another aspect. The solution of the zinc takes place as before; but instead of the hydrogen gas appearing on the surface of the zinc, it now comes off on the copper. If the plates of metal thus employed are very large, and the wire used to connect them is very small, the wire becomes hot. This of course is a new and unexpected feature. An examination into the cause

of this effect shows that a current of electricity passes through the wire as long as there is any acid or zinc to act upon each other. If a wire be fixed to the zinc, and another wire to the copper be brought so as to dip into a second vessel of acid, it will be found that one wire will be dissolved, while the other will emit hydrogen as in the original case. In fact these two ends of wire possess different virtues and chymical qualities.

174. *Rosin Bubbles.*

The method of making soap bubbles is sufficiently familiar not to need description: rosin bubbles are made in a similar manner. A tobacco-pipe is to be dipped into melted rosin, not hotter than just to liquefy it; when the pipe is blown through, bubbles will be formed of various sizes, from that of an egg down to a small bead; and from their metallic lustre and reflection of the different rays of light, they have a pleasing appearance. They generally assume the form of a string of beads, many of them perfectly regular, and connected by a very fine fibre of rosin. Unlike soap bubbles, those prepared in this way have sufficient permanence to bear touching with a gentle hand, and with care will remain perfect for a lengthened period.

175. *To Dip the Hand into Water without Wetting it.*

Dust the surface of a bowl of water with *Lycopodium* (club moss), also rub a little upon the hands; a piece of money, or other object, may then be removed from the bottom of the bowl without wetting the skin. Lycopodium appears to have a repulsive power to water, which in the above experiment is remarkably illustrated. If a small portion of this substance be placed in a quill or roll of paper, and then blown over the flame of a candle, it burns like a flash of lightning, and is used at the theatres to produce that effect. Lycopodium can be had at the herb-shops in Covent Garden.

176. *The Seed of Crystallisation.*

Dissolve three ounces of sulphate of soda (Glauber salts), and two ounces of nitrate of potash (saltpetre), in five ounces of boiling hot water; divide the solution into two bottles; in one place a small crystal of saltpetre, and in the other a crystal of Glauber salts; allow them to cool slowly, when it will be found that saltpetre only will crystallise in one bottle, and Glauber salts in the other, growing up from the crystal seed that it was put in.

177. *Imitation Coral.*

An ingenious person can make up, with artificial coral, a great variety of useful and ornamental articles, such as work-baskets, liqueur bottle-stands, card-racks, candle ornaments, &c., all of which have a novelty in appearance, and are at the same time very pretty. To prepare this coral, procure small branches of shrubs, peel the bark off, and dry them; they are then to be dipped in melted red sealing wax; to every quarter of a pound of which should be added, prior to the melting, one ounce of bee's-wax, which will render the mixture, when cold, less brittle than sealing-wax by itself. Twigs of the black-thorn are the best kind of wood to employ for this purpose. Small articles should be fashioned before they are dipped, but larger ones require the twigs to be dipped first. After they are finished, they should be held before a gentle fire, turning them round till they are perfectly covered and smooth.

178. *Crystal Ornaments.*

Take one ounce each of alum, of Epsom salts, of white, of blue, and of green vitriol, of Glauber salts, and of sulphate of potash; after they are well crushed, mix together these seven salts, and dissolve them in as little boiling water as can be used to perfectly melt them, which will be

about a pint; now place the mixture in a warm situation, where it cannot be affected by dust, or where it will not be agitated. After due evaporation has taken place, the whole will begin to shoot into crystals. Their colour and peculiar form of crystallisation will distinguish each crystal separately, and the whole together will form a beautiful and pleasing object, which, when intended for preservation, should be placed under a glass shade. Any druggist will supply the materials for this experiment for about sixpence.

179. *To Change Water into the Colour of Blood!*

This announcement may, at first, appear rather startling, but after a brief explanation, it may be accomplished without the slightest difficulty. Privately prepare a *concentrated* solution of the 'sulphocyanide of potassium,' and also wash a plate with a strong solution of perchloride of iron. The solution of the potassium (being perfectly colourless) cannot be distinguished from water; and to heighten the effect the plate ought to be a *white* one. Fill a wine-glass with the solution of potassium, and when the plate is quite dry throw the contents of the glass quickly on it, when the apparent water will be instantaneously changed into a deep crimson liquid, resembling, as near as can be expected, 'the blood of a wizard.'

180. *The Chymical Barometer.*

Take a long narrow bottle, such as an old-fashioned Eau de Cologne bottle, and put into it two and a half drachms of camphor, and eleven drachms of spirits of wine: when the camphor is dissolved, which it will readily do by slight agitation, add the following mixture: — Take water, nine drachms; nitrate of potash (saltpetre), thirty-eight grains; and muriate of ammonia (sal-ammoniac), thirty-eight grains. Dissolve these salts in the water prior to mixing with the camphorated spirit; then shake the whole well together. Cork the bottle well and wax the top, but afterwards make a very small aperture in the cork with a red-hot needle. The bottle may then be hung up, or placed in any stationary position. By observing the different appearance which the materials assume, as the weather changes, it becomes an excellent prognosticator of a coming storm or of a sunny sky.

181. *Scraps for the Curious.*

If a tallow-candle be placed in a gun, and shot at a door, it will go through without sustaining any injury; and if a musket-ball be fired into water, it will not only rebound, but be flattened, as if fired against a solid substance.

A ball may be fired through a pane of glass,

making the hole the size of the ball, without cracking the glass; if the glass be suspended by a thread it will make no difference, and the thread will not even vibrate.

Cork, if sunk two hundred feet in the ocean, will not rise, on account of the pressure of the water.

In the Arctic regions, when the thermometer is below zero, persons can converse more than a mile distant. Dr. Jamieson asserts that he heard every word of a sermon at the distance of two miles.

182. *The Game of Natural History.*

This amusing and instructive game is thus played:—The players sit round a room, or stand upon a lawn, in any position they please; one throws a ball at any of the other players, and calls out 'AIR!' The person hit by the ball has then to call out by name one of 'the fowls of the air;' if he fail to do so while any of his companions counts twenty, a forfeit is to be paid, and the ball passed with the word 'FIRE!' The one now hit need not reply to this, but throwing the ball quickly to another, exclaims 'EARTH!' or 'WATER!' just as he pleases; if 'EARTH!' be named, the player struck with the ball must name aloud some 'beast of the field,' or thing that 'creepeth upon the earth;' if 'Water!' be called, then some 'fish of the sea' must be named, or forfeit. 'FIRE!' is

again called, and thus the game goes round. The same thing is not allowed to be named twice during the continuance of the same game. The game may be varied by making the subject of the call mineralogy, botany, chemistry, &c.

183. *Coloured Fires.*

In making coloured fires it is necessary to remark that the materials are to be powdered *separately*, in a mortar, and finally mixed with the hand or a card. Each material that is employed must be perfectly dry. As these mixtures are liable to spontaneous combustion, do not keep them ready made.

CRIMSON.	Parts by weight.
Sulphur	8
Carbonate of Strontia	12
Chlorate of Potash	30

YELLOW.	
Sulphur	8
Dried Soda	12
Chlorate of Potash	30

BLUE.	
Burnt Alum	6
Carbonate of Copper	6
Sulphur	8
Chlorate of Potash	30

ORANGE.	
Chlorate of Potash	26
Sulphur	7
Chalk	16

GREEN.	Parts by weight.
Boracic Acid	5
Sulphur	8
Chlorate of Potash	35

WHITE.	
Saltpetre	30
Sulphur	10
Charcoal	1

PURPLE.	
Chlorate of Potash	30
Sulphur	8
Chalk	12

NEW GREEN.	
Chlorate Baryta	12
Chlorate Thallium	4
Resin	2

184. *Ventriloquy.*

[The following article on ventriloquy has been written especially for this book by Mr. Love, once the ablest ventriloquist who perhaps ever existed.]

Among the peculiar capabilities which have been found inherent in certain individuals, it is probable that none have excited more astonishment in the minds of those who have witnessed the effects produced by the ventriloquist, nor given rise to more controversy respecting the precise action by which those effects are created, or been less satisfactorily explained by physiologists and men of science who have directed their attention to the subject, than Ventriloquism.

There is no doubt that simple ventriloquy was known in the early ages of the world, as many traces of the power are to be met with in the writings of the ancients; and it is the opinion of Monsieur de la Chapelle, who in the year 1772 published an ingenious work upon the subject, that the responses of the Oracles of Greece and Rome were delivered by individuals thus qualified, to serve the purposes of popular delusion. It does not appear, however, to have been known or practised at any period during the middle ages, but we have authority for stating that it has been an efficient instrument in the hands of the magicians and diviners of the eastern world for upwards of *three thousand* years.

The first ventriloquist we read of among the moderns was Louis Brabant, who, if the chroniclers of the period are to be depended on, obtained by a cunning use of his peculiar powers the hand of an heiress. A long account of his feats may be found in a book written by Brodeau, a writer of the sixteenth century.

We may perhaps be permitted to ask whether the ventriloquial power can be acquired by tuition, and practised like most other attainments. A few writers have thought it can; but an overwhelming majority, and among them some whose views upon the subject are entitled to great consideration, have thought differently. Our own opinion is that it cannot; at all events, except perhaps in a very imperfect and unsatisfactory manner. As some examples of the acoustic illusions which the human voice has been found capable of producing when favoured by a natural aptitude and matured by practice and experiment, it may not be amiss to mention a few of the qualifications which a competent ventriloquist must possess.

His capabilities then should consist:—

In the production of various factitious voices, in such a manner as to express them as modified by intervening obstacles, or retiring either suddenly or gradually to a distance, and also the return of the same voices with corresponding effects. In these experiments the slightest shades of difference should be marked with perfect exactness.

In modifying these factitious voices according to the different positions the imaginary speakers are presumed to occupy. In this particular, the performer is guided entirely by the sense of hearing, and consequently must possess one of the requisites necessary to constitute a good musical performer, a correct ear.

In keeping the imagination of his auditors in full play, during the progress of various dialogues and colloquies, and attracting and retaining their attention with a degree of finesse only to be acquired by repeated trials and considerable experience.

In keeping the lips and muscles of the face in a state of rest, especially when they happen to be turned towards the audience during the answers of the imaginary interlocutors, or in any other circumstances in which a contrary move of operation might interfere with the illusion, or when necessary for the general effect of the representation.

In imitating the supposed peculiarities of these visionary speakers, changing rapidly and completely, not only the different degrees of distance as already mentioned, but also the various dialogues, different dialects, varieties of sex and age. The various transient emotions of the imaginary speakers should also be clearly marked and simulated through the medium of the voice, and in this respect the ventriloquist may be said to bear a certain resemblance to the comedian.

145. *Dissected Leaves and Skeletons of Plants.*

The leaves are put into rain-water, and allowed to remain without an exchange of water until decomposition is carried to the requisite extent, that they may be freed from their cuticle and pulpy matter. After macerating them for a short time in fresh, clear water, they may be bleached by immersion in a diluted solution of chloride of lime (one-sixth chloride to five-sixths water). They must be well washed from this fluid when sufficiently whitened, and quickly dried before the fire or in the sun. Care must be taken not to allow the decomposition to be carried too far, or the fibrous structure will become injured also, nor must the specimen remain too long in the chloride, or injury will likewise ensue. Leaves with strong fibre should be preferred. The fibrous parts, the seed vessels, and the calyces should be cleared with a fine camel-hair brush. When the pulpy matter adheres too strongly, it may be removed by a stream of water poured upon it, assisted by a small brush tool. When the skeletons of plants are thus prepared and arranged in a group, they form an elegant and instructive ornament. Such delicate fabrics of course require a glass shade for their preservation.

186. *Leather Modelling.*

According to the rule of the day, the custom or fashion of the period, ladies amuse themselves in various ways. At one time it is 'tapestry,' at another 'embroidery,' then 'bead purses' and 'bead reticules,' 'papyroplastics,' or modelling in paper, then 'crochet;' and so the fashionable amusements change. It is certainly due to the ladies' taste, patience, and energy in such amusements that we have handed down to us those splendid pieces of needlework now hanging at Hampton Court, and many other trophies of their handiwork. Well, the present fashion is 'leather work;' and as the adage says, 'nothing like leather,' let us hope that some good will be derived from it. There is little doubt but the general taste for the proper adaptation of ornaments in our homes will be improved, and that many lasting works will be constructed. Leather is a very durable material, and ornaments made of it may be expected to be handed down 'from generation to generation.'

To teach the art of leather modelling is beyond our capacity; but, nevertheless, we may perhaps not uselessly convey a few hints relating to it.

The best description of leather for modelling is that known as Basil and Skiver leather, taking care to choose it soft and free from blemishes, of a light colour and even texture. In modelling flowers and fruit all the small work is best done

with skiver, while for the larger work basil is used. All leather used is first wetted, and then shaped and formed while in this state. The only tools necessary are a few punches for striking out small leaves, a leather cutting knife, scissors, a small hammer, a veining tool, a few brushes for applying the various colours and varnishes used in finishing the work, and a little liquid glue for putting the models together. When the various leaves of flowers are not cut out with a punch they may be copied thus:—Sketch the design upon cardboard, then cut it out very neatly, and place a piece of basil leather (previously damped) quite flat upon the pattern, or rather place the pattern upon the leather, then trace the design (from the outer edge of the card) with a hard blunt point, such as a blunted darning-needle, or any like-fashioned tool. Those who can draw will sketch their patterns upon the leather at once, and thus expedite the process. The leaves are veined by the veining tool; they are then to be bent and shaped into the form that they are to take in the finished model. When the designs thus made are thoroughly dry, they are hardened by being brushed over with what is called stiffening. This is made of a strong solution of parchment size, or of a solution of Australian gum and shellac in spirits of wine. As most of the models are done in imitation of oak carvings, to which the colour of the leather renders it particularly applicable, it

is usual to stain the work with what is termed oak staining; to make which is attended with some trouble. It is therefore better to procure it ready for use at shops where such articles are sold; for instance, at REVELL'S, 272 Oxford Street, may be purchased not only the materials, but instructions for using them.

The leather flowers are painted of the various colours required by the application of fine powdered colours mixed with white of egg or distilled vinegar, or weak gum-water, according to the colour: after they have been applied with a fine brush, and the colour is dry, they are to be varnished with a quickly-drying pale varnish.

The judgment and taste that are required to group the various flowers, such as the convolvulus, hops, passion-flowers, camilla, jessamine, daisy, roses, ivy, vine, and oak leaves, &c., &c., must depend entirely on the artistic skill of the modeller. The objects best adapted to be made are brackets, watch-stands, card-racks, picture-frames, baskets, and such-like ornaments. Skeleton frames are required to construct brackets, to which the ornaments are attached with small pins, tacks, and the liquid glue previously mentioned. Tendrils are made by winding a strip of moistened skiver over a stout wire, each end being fastened so that it does not fly off; when dry, the tendril may be drawn off the wire, and glued in the position required. With these hints we leave our modellers

to become workers in the practical art of leather modelling.

187. *Potichomanie, or Glass Ornamenting.*

About forty years ago it was the fashion for ladies to amuse themselves 'and pass their time away' in cutting out flowers, birds, and insects, from odd pieces of chintz; then by the exercise of a little ingenuity, they fastened them into the interior of bottles; finally the bottles were filled either with chalk, salt, or any white material, to form a ground to the fanciful picture produced. Such bottles, the handiwork of grandmama when she was a girl, are still to be seen here and there on the high mantelshelf. This art—if art it can be called—has recently been revived, and slightly improved, under the title of 'Potichomanie.' At the shops where fancy goods are sold will now be found all the materials required—vases in transparent glass, of classic forms, Etruscan and Pompeiian, curious designs, Chinese figures, flowers, reptiles, &c., printed in colours upon paper; gum, varnish, brushes, &c. As of old, the designs are cut out of the paper, varnished at the back, and then gummed into the interior of the glass vessels. Instead of using bottles, vases expressly made for ornamentation are now manufactured; hence the results, when complete, *are* forms worthy of the work. The designs, too,

are very superior to the old chintz patterns, being now printed upon paper, with all the improvements of design and brilliancy of chromo-lithography; the effects are more pleasing, especially as gilding is introduced into many of the pictures. After the pictures or designs are all fastened into the vase, a ground colour is applied, the shade of which should harmonise with the subjects. The ground colour being poured into the vase, a rotatory motion is given to the potiche, for the purpose of diffusing it equally over every part. The ground colour is prepared with flake white and varnish, thinned with turpentine, tinted either with chrome, ultramarine, Brunswick green, Prussian blue, or carmine with chrome, &c. After the ground colour is perfectly dry, the vase or potiche should be lined with a coating of plaster of Paris, made with water as thin as cream. Being poured into the vase, it is run round it in the same way as the ground colour, by turning the vase until the plaster sets, which takes place in a few minutes; this gives weight and solidity to the vessel. If the vase is required to hold water for cut flowers, the plaster lining must be saturated with good drying linseed oil. Taking all things into consideration, potichomanie is as likely to improve the taste of those who pursue it, as crochet, leather-modelling, and such-like amusements.

A friend sends the following: — In order to get

the ground colour to dry quickly, he dissolve an ounce of white shellac in two ounces o. spirits of wine; and this formed a varnish which, when mixed with the ground colour, dried hard in less than five minutes. Another who has had fourteen years' experience in the varnish trade, remarks, that although the above-mentioned varnish will dry, as described, yet it possesses no body whatever. 'It will,' he continues, 'chip and scratch with the slightest friction; for instance, if a vase were filled with artificial flowers, the wire or wooden end on which they were fastened would be quite sufficient to produce scratches. Although hard or spirit varnishes should not be used, yet oil varnish is most proper, namely, cabinet varnish, which possesses great body, and dries extremely hard in about two hours, but sets almost immediately, thus preventing colours from running. For vases intended to hold water for fresh flowers, I should recommend the colours to be black, red, or green, and thus mixed: — One half gold size (japanner's), one half oak varnish, and gently heated for two hours before the fire to further harden it; it will then resist cold water for years. It is not advisable to use gold size with any colours except those above mentioned, because it changes them to a dingy hue.'

188. *Novel use of the Perforations from Postage Stamps in Potichomanie.*

There are thirty-four perforations required round each stamp; the weight of each cannot possibly be expressed in our language, but the total produce amounts to no less than one ton. There is a story told that when these perforations were first produced a sample was sent to a celebrated botanist, and palmed off to him as being 'a seed;' however, after it had been duly 'committed to the earth' the trick was found out. It is very difficult to find anything that is entirely useless. Until very recently, however, the perforations from postage stamps were considered of no value whatever; but Mr. REVELL, of Chiswick, has not only made them useful but ornamental, as a ground colour for the potichomanie vases. After the designs are fixed into the vases, liquid gum is poured in, and the vase turned round so as to cover all the vacant spaces. The perforations are then thrown in, and as they adhere to the glass an effect is produced, closely resembling polished porphyry, or granite.

189. *What a Glass full of Water will hold.*

It is generally thought that when a vessel is full of water, any solid substance immersed in it will cause it to overflow, and such will be the case

if the substance is not soluble in the water; but the philosophic truth, that in dissolving a body, you do not increase the volume of the solvent, may be proved by a simple and interesting experiment. Saturate a certain quantity of water, at a moderate heat, with three ounces of sugar; and when it will no longer receive that, there is room in it for two ounces of salt of tartar, and after that for an ounce and a drachm of green vitriol nearly six drachms of nitre, the same quantity of sal ammoniac, two drachms and a scruple of alum, and a drachm and a half of borax — when all these are dissolved in it, it will not have increased in volume.

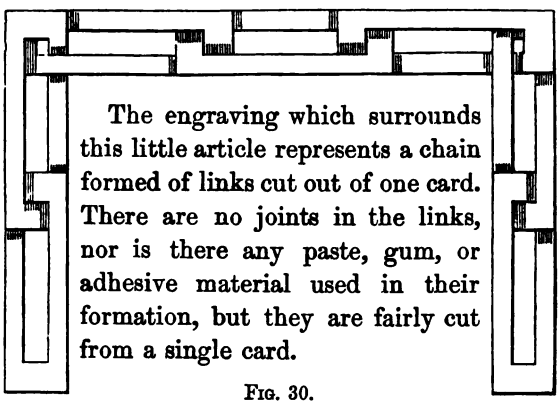
We should observe that the salts used are to be 'anhydrous;' that is free from the water, which they take up by crystallisation. Nearly all salts can be rendered anhydrous by exposure to a high temperature which dries out the water. It is interesting to observe that during this operation nearly all metallic salts lose their colour; the sulphate of copper for instance is blue in its crystalline state, but becomes white when 'anhydrous.'

Another, although somewhat of a similar experiment, may be shown thus. Fill a goblet with fine cotton wool, now take out the cotton and replace it with water 'to the brim,' then very gently let the cotton down into the water and it *will be found* that the glass will hold both water

and cotton at the same time; thus it is twice full at one and the same time.

Note. — In this latter experiment, it is necessary to cleanse the cotton from the natural grease always adhering to it, by first boiling the cotton in an alkaline ley, such as soda or potash in water, then drying it and combing it out into its snowy form once again.

190. *The Card Chain Puzzle.*



The engraving which surrounds this little article represents a chain formed of links cut out of one card. There are no joints in the links, nor is there any paste, gum, or adhesive material used in their formation, but they are fairly cut from a single card.

FIG. 30.

Solution of the Card Chain Puzzle.

Take a card, say four inches long and two and a half inches wide, or of any other size thought fit; but the larger the card the better it is for practice. Draw a light pencil line from A to B,

and another line from C to D, at about a quarter of an inch from the edge of your card. Now lay the card in water for a short time; after which split it down from the edge with a pen-knife, as far as the pencil line, and then put the card aside until it is perfectly dry, when you will resume your task as follows: — with a sharp penknife cut right through the SOLID STRAIGHT lines indicated in the engraving, but only half way through

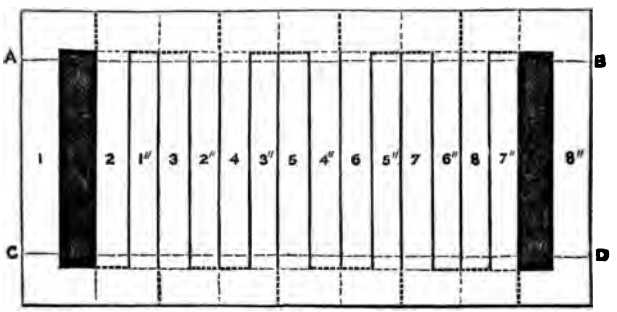


FIG. 31.

the *dotted* lines, as that is the *split* portion of the card. The engraving, fig. 31, shows the upper and under side of the card, the straight lines are cut clean through; the thick dotted lines are to be cut half through — that is the split half — on one side and the thin dotted show where the cuts are to be made on the reverse. The black bar is to be cut quite out. The figures show the bar of each link of the chain. Thus 1 and 1″ belong to *the same* link, and are connected at the top and

bottom, the latter by the upper half of the split; and the former by the under half of the split; the links 2 and 2″ are also connected in the same way, and soon to the end of the chain, until every link is released, thus forming a cable, which, if not useful for any mechanical purpose, will at least serve to amuse.

191. *Science in Sport: The Law of Force.*

If a stick be taken and tapered off to the ends equally from the centre, and the stick itself be not too thick, and if it be then placed with its tapered ends resting on two wine-glasses, a good smart blow being struck on its centre, will break it in two without damaging the wine-glasses. The cause of this involves a curious principle of the law of force, of which there are many illustrations well known. The blow being given very quickly and evenly, and the substance which strikes having a rapid motion, it is suddenly arrested in its downward course by the stick across the wine-glasses, and it passes through it, or breaks it, because there is not time enough for the momentum of the blow to spread along the stick and break the glasses. Another illustration is firing a candle through an inch board. If a gun be loaded with powder, and a candle just fitting the barrel be inserted in place of a bullet, and the gun fired against a door or other piece of wood, the candle will pass through,

leaving a clean smooth hole, because when the candle comes to the door, it is evident something must give way, and as the candle is moving so fast, it actually has not time to break, and the wood is perforated.

192. *Nonsense.*

Amazing nonsense will always make people laugh; sometimes, in consequence of the failure of one of your tricks, it will be necessary that you divert the attention of your audience and make them laugh. I have generally found the following nonsense written by Foote to test the memory of Macklin, answer very well.

'So she went into the garden to cut a cabbage-leaf, to make an apple-pie; and at the same time a great she-bear, coming up the street, pops its head into the shop. "What! no soap?" So he died and she very imprudently married the barber; and there were present the Picninnies, and the Jobillies, and the Garyulies, and the Grand Panjandrum himself, with the little round button at top; and they all fell to playing the game of Catch-as-catch-can, till the gunpowder run out at the heels of their boots, as they ran to fetch the Magician to mend the frying-pan and do the trick over again.'

193. *Experiment in making Gas.*

A very pleasant experiment, illustrating the method of manufacturing gas for lighting purposes,

can be tried at the cost of a large clay tobacco pipe, thus:—Fill the bowl of the pipe with fine coal, then cover the top, or as the chemists say, lute it over with a little clay. Now thrust the bowl into the fire, leaving the stale of the pipe projecting from the bars. In a few minutes the heat will separate the gas from the coal, and having no other exit, it will escape from the end of the pipe, where, on the application of flame, it will burn with brilliancy for five or six minutes.

194. *The Funny Funnel.*

This magic instrument consists of a small funnel, placed in a larger one, and united to it only

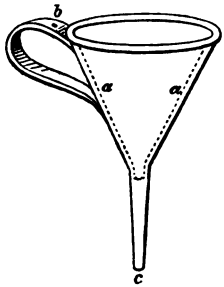


FIG. 32.

at the top, thus forming an open space *a a* between the two.

The handle being held in one hand, and the opening *c* being stopped by a finger of the other hand, the funnel is completely filled with water,

so as to allow the liquid to flow over from the interior into the space *a a*. The thumb is then placed upon the aperture *b* and the finger withdrawn from *c*, when all the water in the inner part will of course run out, but the liquid contained in the outer compartment *a a* will be retained by the pressure of the atmosphere at *c*, which is not counterbalanced by any corresponding pressure at the upper surface.

However, immediately the thumb is removed from the aperture *b*, the air will enter it and find its way into the compartment, and the pressure being thus counterbalanced, the water will all be discharged from it. It will thus seem as if the fresh supply is derived from some magic or invisible source. In showing a trick with it we induce one of the company to drink out of the funnel, and then cause the liquid to flow out of his elbow or his ear, to the great delight of all the boys and girls in the room.

195. *Singular Experiment with Amorphous Antimony.*

When antimony is deposited by the electro-plastic process from a solution of tartar emetic in ordinary chloride of antimony, the properties of the deposited metal are very different from those of the antimony of commerce, and it also differs from the same metal that is deposited from

tartar emetic and tartaric acid in dilute hydrochloric acid. Mr. G. Gore, F.R.S. exhibited to the Pharmaceutical Society the following experiment. The little bar of antimony held in his hand was made hollow, and in that hollow space water was placed. On striking one end of the bar with a hammer, a sudden molecular change occurred in the metal, attended by an elevation of temperature so great that the water boiled, and the metal passed from the amorphous to the crystalline state.

Mr. Gore has kindly favoured me with the following remarks: — 'Much amusement has on many occasions been produced at juvenile parties, soirées, &c., by taking a number of small fragments of the active metal about $\frac{1}{16}$th or $\frac{1}{12}$th of an inch thick and about $\frac{3}{8}$th or $\frac{1}{2}$ an inch square, handing it round in single pieces to persons with a request to hold it *very firmly* between the finger and thumb of the left-hand and rub it *quite hard* with the edge of a new sixpence or fourpenny piece or anything *hard* and *rough*; it then quickly evolves so much heat as to adhere rather strongly to the fingers, and much amusement is created by the violent motion used to get rid of it.

The best way of preparing the substance is to take two parts of hydrochloric acid or of chloride of antimony, add as much oxide of antimony as it will dissolve with much stirring, and then add

one part more of the acid: tartar emetic may be substituted for the oxide of antimony. Pass a current of electricity from a small galvanic battery through the solution by means of an anode of antimony, using a cathode of clean thin sheet copper to receive the deposit of metal. Continue the action for about two or three days, until the deposit is about $\frac{1}{16}$th of an inch thick on the copper. Transfer the coated copper to a *wooden* bowl into which a stream of cold water is running, and bend the sheet of copper very slowly and cautiously; the amorphous antimony will then fall off in large plates, which should be at once removed and broken upon a surface of wood under cold water into fragments of the desired size by gentle blows with the end of a wooden rod; the fragments should then be wiped dry and placed at short distances asunder upon a narrow strip of cotton-wool, which may then be formed into a roll and kept for many months, or conveyed with safety.

After a fragment has *once* evolved its heat, it is valueless, as it does not evolve heat a *second* time.

A mass of the substance $\frac{1}{2}$ an inch thick evolves sufficient heat to melt tin and other metals, but no flame is produced, nor is paper or cloth actually *ignited* by the heat.

196. *Enigma.*

What is that which is now in my hand? I bought it yesterday and brought it home, yet I have never seen it! The shopkeeper that sold it to me had never seen it! None of the passers by ever saw it, though it was in the centre of his window for more than a week; indeed, it travelled from the merchant abroad, and through various hands, before it came to mine, yet has never been seen at all. I will now show you this visible-invisible thing; and, after I have shown it to you, it may never be seen again. This was the Enigma Harry proposed to his Aunt Mary, which she, not being able to solve, 'with all her learning,' he enlightened her by *cracking a Nut*, holding forth the kernel, and then swallowing it. The good old lady's sides shook, as she gave Harry a new florin, with a promise that it should be repeated every time he brought her 'a nut' that 'she couldn't crack.'

197. *Ice made in a Drawing-Room.*

The operative chymists sell small glass vessels which are called test-tubes; they are of thin glass and hold from one to four drachms, and are very useful for the purpose of trying small experiments. The following is a simple and singular method of freezing water. Ask mamma to lend

you a jam jar, fill the same with powdered sulphate of soda, now pour on the saline material as much muriatic acid as will render it semi-fluid, then fill a test-tube with water as cold as you can procure, and put it into the centre of the chymical mixture: let it remain at rest for ten minutes or so; finally, take out the tube and wipe it dry; you will find the water frozen. To get the ice out of the tube dip it for an instant into warm water, the cylinder of ice will then fall into your hand.

198. *To prove that Sugar is a Compound of Charcoal and Water.*

Place about half an ounce of powdered white sugar in a glass tumbler, then pour upon it as much strong oil of vitriol (sulphuric acid) as will cover it, and stir the mixture with a piece of wood, or a glass rod. In a minute or so the sugar will blacken; the mixture will become hot; steam (that is, water) will be evolved, and charcoal be deposited in the glass. This 'sweet experiment' is an apt illustration of the simplicity of composition of organic substances produced by plants. Sugar, starch, and gum produce similar effects when treated in the same manner; they are, in fact, all compounds of charcoal and water, in different proportions.

DYMOND, BOLTON, & Co., 146 Holborn Bars, are *first-rate* makers of pure chymicals.

199. *Pyrotechny, or Fireworks.*

The word pyrotechny is derived from two Greek words, which signify *fire* and *art*; it was originally used in a military sense, and implied a knowledge of the art of using gunpowder in warfare. In the present day pyrotechny is understood as fireworks for the display of devices and colours of a burning substance, used as signals of distress or joy. All fireworks are composed principally of gunpowder; that is, saltpetre, sulphur, and charcoal, in different proportions. For pyrotechnical displays the gunpowder is used in the form of a fine flour, commonly called meal powder, while for the 'shooting iron' the gunpowder is formed into fine grains, like seed. The mere difference in the mechanical state of the ingredients causes a great difference in the way it burns. In the grain, as ordinary gunpowder, it 'goes off with a bang;' but in the meal it merely burns with a 'fizz.' Thus a rocket is filled three parts with meal powder, and the end or fourth part with grain powder; and it is this latter which explodes when the rocket is high in the air. The mathematical part of pyrotechny consists in calculating the size of the aperture, as well as the length and diameter of the several parts of what is called a piece; and if this be not done with the greatest nicety, the various subdivisions of a piece do not take fire at the appointed moment. In works upon the sub-

ject various tables are given, in order to facilitate these calculations; the weight of the poise stick, and its length have also to be regulated to suit the size of the tube and weight of the rocket. The various colours that are so exquisitely shown in fireworks, consist of—strontian, an earthy substance found at Strontia, in Scotland; this produces brilliant *crimson*; salts and oxides of copper produce *blue* and *green*; zinc and antimony yield *blueish white*; iron filings and borings make fine 'stars;' camphor and benzoin yield 'odorous fumes' and 'white fire.' The 'golden rain' is dried hard wood sawdust. Great skill is of course required in mixing these ingredients, especially so as regards the disposal of them in their right places. To produce a given effect the case is sometimes filled three parts with meal powder, and the fourth with plain gunpowder, mixed with pellets made of the coloured fires described at 157.

200. *The Gun or Pistol Trick explained.*

Every science has its difficulties and its puzzles. The 'Times' said the comet of 1859 proved the very crux to astronomers; in like manner has the Gun and Pistol Trick been in the schools of magic. This illusion seems to combine in itself all the difficulties and problems of observation and calculation—it is the most inscrutable leger-demain! Yet when you know how 'the trick

is done,' and the problem is solved, nothing proves more simple and easy. Here is the solution:— The Pistol Trick is done with real powder, real bullets, and a real pistol; the deception rests with the magician's wand—the ramrod. This wand or ramrod is made of white metal or of polished iron. On one end is very nicely fitted a tube, like a telescope tube, or a very long thimble. When the tube is off the rod, there will, of course, appear a little shoulder or projection: the other end of the rod must be made to resemble this exactly. We will premise that the magician is now about to show the illusion, the little tube is on the wand in his hand unobserved.

A pistol is now handed round to the audience and examined; one of the company is requested to put in the powder: this being done, the magician now puts in the wadding and *rams it down with his rod;* in doing so he dexterously leaves the tube or long thimble inside the pistol barrel. '*It is not mechanique!*' says he, and can now hand round his wand for examination. One of the audience now holds up the pistol and any of the company place into the barrel the marked bullets; a little more wadding or paper is now required, which the magician rams down; in doing so, the rod slips on to the tube, which, in fact, now forms an inner lining to the barrel, and into which the bullets have fallen; the tube fitting tight on to the rod is now withdrawn with it from the pistol, and

thus the bullets are now readily got into the hand by pulling off the whole from the rod. The magician can now again offer the rod for examination to any of the sceptical. 'Prepare to fire,' says he, '*I will go and fetch a leetle plate to catch de pullets!*' then, returning, he requests the marksman with the pistol to 'Fire!' Bang!! and the bullets fall from the illusionist's hand into the plate.

201. *The Escaped Prisoner.*

About forty-eight miles from London, and ten from Cambridge, is the old market town of Linton, with its fine old Church—one of those quiet peaceful places that your Gilbert Whites and William Cowpers delight in. A short distance from Linton are three large barrows or mounds, at a place called Bartlow. A few years since the Archæological Society of London received permission to open these barrows, all of which are in fact the tombs of Roman leaders; for Linton itself was probably a Roman camp, and Bartlow its outpost, where the leaders were buried just previous to the advent of the Anglo-Saxons into Britain. I was there at the opening of these *tumuli*, and saw a glass vase containing the burnt ashes of what was once part of him whose grave we were thus scientifically desecrating. Several coins, one of which I have by me now, and 'warlike stores,' were also found there, a full description of which is to be found

in the Society's printed reports. For three days and nights, at the Red Lion, F.R.S.'s, F.A.S.'s, Ph.D.'s, and all similar literates and illiterates, were as plentiful as poppies in a corn-field. Quite late one night during the time, I was sitting in 'the Lion' parlour, smoking my cigar, leisurely puffing and whiffing the rings of smoke as they curled upwards. On the opposite side of the fire-place sat an elderly gentleman, a true Jonathan Oldbuck every bit of him, from the buckles on his shoes to his crop-white hair. Pleasantly passed the time as we chatted on a long while about nothing, and all things, and everything else. Linton was fast sinking into repose, but my friend seemed to be waking up for the evening; so instead of calling for 'boots' to bring me slippers, and having my soles duly chalked '$\frac{1}{6}^{3}$' — room No. 13, call me at six—I called for another 'go;' for my new friend's loquacity increased till I became quite interested in his conversation. He told me of his early history, his unfortunate speculations on the turf, and his quarrels with his friends; how he enlisted into the 93rd — their doings in the Peninsula, their retreat under Sir John Moore, and his own appearance under the walls of Badajos; then he reverted to the desperate wound he received there, which had paralysed one arm to the present time; and how Sir Arthur Wellesley specially singled him out for promotion; his reconciliation with those near and

dear to him; and finally, the happy position he was left in by his aunt. 'During the time I was corporal,' said he, 'the following incident occurred. I was on picket one night, and not gone my lonely rounds more than half-an-hour, when I heard footsteps in the direction of San Sebastian. The next moment these steps were upon my beat. My piece was primed, but before I could present arms two black eyes, like jet set round with rubies, were imploring me for life, while a voice, sweet as the melody of distant music, craved mercy not for herself, but for a brother. "You are my prisoner," said I, and proceeded to tie her hands. "Pray, pray release me, and pass me through the lines, that I may yet reach Barcelona before my brother sails." As to letting her escape me or approach the British lines, then intersecting San Sebastian from Barcelona, I well knew would be but signing my own death-warrant; for the law of Wellesley was that a captain of picket who should let a spy into camp should forfeit his life. I therefore tied her wrists firmly together, then passed a cord through the arms, and finally, securely fixed the loop round a large chestnut-tree, intending to leave her there till the sun-rise, when I might with greater security take my captive to head-quarters. Feeling perfectly satisfied in my own mind of the security of my prisoner, I continued my beat, which extended about half a mile. I must now leave

you to imagine my chagrin on returning to find that she had escaped — and the more so as, examining the cord round the tree, I saw that it was quite perfect. As to her releasing her wrist, that I knew was impossible. How then did she manage to get free? This is the puzzle I shall leave for you to solve.' With this he left me, bidding me good-night! Now I had some recollection of having seen something like this tying and loosening done in play by young men and maidens when I was young myself, and the way they did it was this: — Having tied the wrists of their prisoner together with a piece of tape, they passed a cord through the ring formed by the arms, and fastening the ends of the cord to a chair, or any other suitable object, they would then say, 'Release yourself if you can; but remember the handcuff is not to be removed nor is the cord to be cut, nor in any way damaged.' This was always a favourite puzzle to play off upon those who did not know the secret, and to revive it now will be well-timed, as it can be managed out of doors as well as in a room. To release yourself: — Make a loop of the cord, and draw it through the centre of the ring of tape between the wrists; then pass this loop over the hands to the back of the fingers, when pulling slightly, the cord will slip under the outside of the fastening to the wrists, and you are free!

202. *Pyrophorus.*

We are able to accomplish many things now-a-days which have a parallel only in the enchantments of the Genii of the 'Arabian Nights;' and indeed to the unlearned eye some laboratory experiments appear something more than marvellous. A very remarkable class of bodies made by the laboratorians are the pyrophori, or fire bearers. There is a liquid called Alcarsin, which when poured from a phial into the air spontaneously takes fire, burns with a white flame, and evolves a most intense odour. Those who witness this singular experiment are as amazed as Aladdin, when the African magician said, 'You see what I have done by virtue of my incense!' Alcarsin, Cacodyl, and similar liquids, can however only be made by experienced chymists; but what is known as the alum Pyrophorus and the lead Pyrophorus are easy of preparation, and fit experiments for philo-chymists, who are climbing the ladder of learning, as we shall now illustrate. Dissolve one and a quarter ounce of acetate of lead in a glass of water; also dissolve half an ounce of tartaric acid in water, as you would do in mixing a seidlitz powder; then mix the solution — a white, cloudy precipitate falls, called Tartrate of lead; collect this on a filter, and dry it for use. Fill any small phial one-third full with dry Tartrate *of lead,* stand it upright in a small crucible, then

fill up the crucible with sand, and the phial will remain in position. When this is done, stand the crucible in a little nook of a small and clear fire. In due time it will become red hot; empyreumatic vapour will rise from the bottle, which will burn with a pretty blue flame. When there is no more vapour remove the crucible, and put a piece of chalk over the mouth of the bottle till it is cold enough to handle, then insert a good cork to keep out air. The contents of your phial is now Pyrophorus, and if poured out into the air it will take fire. Another Pyrophorus may be made in a similar way, with three ounces of alum and one ounce of sugar dissolved and evaporated to dryness. Both these Pyrophori are in the form of a dry black powder, and maintain their quality for a lengthened period, if kept from the air. Another Pyrophorus—but one that should only be used in the affairs of war, so dangerous is it—may be made by wetting Gun Cotton with a solution of Phosphorus in Bisulphide of Carbon; this, thrown into an enemy's camp, will explode so soon as the liquid has evaporated. Thus the followers of St. Januarius may perform a miracle to mystify his votaries.

203. *To Swallow a Barber's Pole.*

The modern conjuror has degenerated into a serious black-tailed coat and white neck-tie gentle-

mar.. As to making you laugh with a good 'Ha! ha!—he! he!—Hi! hi! Ho!' Oh! dear! that is quite out of the question. As Sam Slick says, 'taint conjuring now; 'tis illusion, an' no laughing allowed!' When I was a boy and went to see the conjuror, I didn't get over it for a week: my sides used fairly to ache with laughing, and the tears gushed out of my eyes till I couldn't see. I remember one trick in particular that pleased me exceedingly; and I'll tell you how it was done.—First, there was the conjuror, standing before about a bushel of paper-shavings; then he used to 'set to' and pretend to swallow the shavings like dainty maccaroni, making all the while such queer faces, sometimes like Jessie over jalap in jam, then like our Theodore in front of cherry pie. 'Well, then,' he used to say, 'I won't be greedy! Will any lady or gentleman take a little supper? There is no gravy, no salt, no pepper; the best sauce is a good appetite.' And so at last the paper disappeared to a quarter of the original bulk. Then followed a good deal of rubbing and puffing; finally, a little stump, gradually growing and growing, appeared at his mouth, till at last a pole, reaching up to the ceiling, twisted in various colours, left us to wonder how he had such an enormous swallow. A few years ago I found out how this pole was made, and like all other conjuring tricks, this turned out the most simple thing in the world when ex-

plained, as you will perceive by the following instructions. Procure three sheets of cartridge paper; cut them into long strips three inches wide; now colour each side one inch wide, one blue the other red, leaving the middle white; now paste all the strips together lengthwise, and they will form a band of six yards long. Now roll up the paper upon itself, like a ribbon in a haberdasher's shop; leave a little piece in the centre twisted awry, so as to form something to pull at from the middle. When rolled up, the hand will grasp the roll without being scarcely perceived, especially when there are a few shavings about. When the middle of the roll is pulled a barber's pole is instantly produced, to the surprise and delight of every beholder. In doing the trick the chewed paper-shavings are easily removed from the mouth every time a fresh handful is taken up; and when it is time to produce the pole, you have only to put the roll, concealed in a handful of shavings, up to the mouth with the left hand and pull out the centre with the right. To swallow the pole, a slight downward pressure will cause the roll to fall into its original form. Every descent of the pole must be made with a gulp! I need not say how all the little folks will laugh on witnessing this trick, and how they will remember what a capital family party they had, and how it will be heralded to many a happy home!

204. *Geometrical Magic.*

An artist had a square window in his study a yard high and a yard wide; finding there was too much light he had exactly one half removed, this the architect did, and still left him a window, a yard high and a yard wide. The question is: How was the alteration made? For solution see p. 261.

205. *How to Plant Eleven Trees in Ten Rows.*

A great variety of geometrical puzzles, of which the sketch below will illustrate one of the class, is kindly furnished by MR. HEWITT, of the Training College, Battersea. Nine trees can be put into eight rows of three each, thirteen into twelve rows of three each, and so on.

Eleven Trees in Ten Rows.

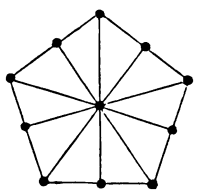


FIG. 33.

Thus, ten alongside of a pentagon and one in the middle.

206. *The Rolling Ball of Fire.*

Fill a plate with water, cut a piece of thick *blotting paper* round, the size of the plate, lay the

paper very carefully upon the water where it will float and show a damp surface.

Now place a piece of Sodium upon the paper; in a few seconds it will be observed to take fire, and roll about the surface of the paper in a very remarkable manner.

BELL BROTHERS, of Newcastle-on-Tyne, make Sodium now for 10*s.* per pound; when I was a boy it cost 80*s.* an ounce.

207. *The Magnetic Wine Glass.*

Place a watch with its glass side upwards upon a table, then balance upon it a long tobacco pipe; now take a clean wine-glass and rub it with a dry

FIG. 34.

and warm silk handkerchief, it will become magnetic; and if the cup of the glass be brought near to the waxed end of the pipe it will attract it, and if the pipe be nicely balanced one can make it spin round.

208. *Diaphanie, or the art of imitating Stained Glass.*

The potichomanie process, see page 226, is adapted for ornamenting opaque glass only, such as vases, epergnes, spillholders, &c., and thus

differs from Diaphanie, which is for transparent glass, such as windows, lampshades, conservatories, screens, &c.

Diaphanie has now made sufficient progress to induce several retail houses at the west end of London to sell all the materials requisite for the process. These consist of the printed designs, the brushes, the transparent varnishes, and the colours. Almost any picture, printed either in colours or plain, will become transparent if brushed over with a bright clear varnish, such as Sandrach varnish (gum sandrach in spirit), or Canada balsam in turpentine.

The method of proceeding is as follows: Suppose it is intended to ornament a staircase window; first obtain squares of glass of the proper size to fit the sash, then lay down one of the squares on a flat board, having a groove so as to prevent its moving during the operation, the commencement of which is to polish it quite clean and bright; this being done, coat it over with a thin film of transparent varnish, and then allow it to partially dry. While this is doing, arrange the design of coloured papers, or employ an engraving, lithograph, or photograph on paper.

In making a design of coloured papers attention must be paid to the harmonious distribution of the colours; thus the complementary colour of *purple is* yellow, that of blue is orange, the best

contrast to red is green; with a red ground, blue and yellow borders are required; with a blue ground, yellow and red edges are most suitable. Green, orange, and purple may be used more freely than red. Red and yellow are best suited for windows of northern aspect; while blue, purple, and green are most appropriate where there is an excess of light. Besides plain coloured grounds, Diaphanie is capable of imitating works of art, such as historical subjects, both sacred and profane; portraits and animals; landscapes and flowers; armorial and mediæval devices, &c.

Presuming now that the varnish with which the glass has been coated is sufficiently dry to act as a cement for the paper, engraving or photograph, brush over the face of the design a coat of the transparent varnish, and then proceed to lay it down on the glass in such a manner as not to require shifting. If only slightly out of place it can be rectified, but if very crooked the design must be lifted, and again laid down more carefully. If there are any air-bubbles under the pattern they can be removed by scraping a stiff card over the picture, drawing the air from the centre to the side. The design can also be flattened down on the glass by placing a sheet of paper upon it, and rubbing it with a soft duster.

The patterns are now left to dry for twenty-four hours, and if then they adhere perfectly to the glass, they must be brushed over with a coat

of transparent liquid, and again left to dry, and finally varnished. When the diaphanied squares of glass may be said to be complete, and have then only to be placed in their position to show their exquisite effect, and being already cut of the size to correspond with the panes of glass in the window, they are easily held in the sash by a few small pins, or brass brads: the picture side of the glass is to be placed next to the window-pane, so that the unprepared side can be cleaned as other windows are.

In large towns there are always back windows, with anything but a 'bright prospect.' Now, ladies with taste can make these 'look outs' objects of admiration and elegance. Mr. Marrios, of 152 Regent Street, supplies all the materials for Diaphanie.

Diaphanie has the merit of combining moderate cost with durability and beauty; and there are few people who do not love the labour of their own hands, or of those who are bound to them by ties of love and affection. When the worker shall have passed away, these memorials of her taste and industry will still remain; and when the first grief of the mourner has become but a pleasurable recollection of the past, they will be treasured as household gods. An old map, worked in silk, hangs in our library; it is a sampler of—never mind of whom—of somebody, when she was a little girl at school. I would not change it

for a work of Raphael's or Hogarth's. Future generations will say the same of those who now work at Diaphanie!

209. *To take an Impression of a Seal or Coin in Wax.*

Few persons can take a perfect or even a good impression of either a stone seal or a metal coin. The principal cause of failure arises from placing the seal or coin quite cold upon the melted wax. The cold stone 'sets' the wax before it can enter the fine lines of the work.

Metal coins being better conductors of heat act in this way even quicker than stone. The first thing to do, therefore, to obtain a good impression, is to warm the seal or coin before it be placed upon the sealing wax. The proper heat is about that which can be borne upon the cheek without inconvenience when they are placed there 'to feel them.' There are also two other points to consider in taking an impression — one is to prevent air being enclosed under the seal, the other to have the wax neither too fluid nor too thick. To prevent air being enclosed, place the seal or coin on to the wax with a diagonal motion, and not, as is often the case, with a flat or horizontal thrust. The reason for this practice is, that if the seal be suddenly put flat on to the wax, the little air within the engraved parts

cannot escape, and, being expanded by the hot wax, makes a vexatious 'bubble' at a part most desired to be perfect. A deep-cut shield is very liable to inclose an air bubble. To avoid it place one edge of the seal into the wax, and then quickly lower it to a horizontal position, exerting great pressure before the seal be let go.

In practice, the seal is not to be snatched off immediately, but time must be given for the wax and seal to cool. The seal should then be lifted off with the same kind of diagonal motion as it was put on with; that is, one side is to be lifted first, then gently raise it. If lifted quite perpendicularly the seal acts to the wax as a schoolboy's leather sucker does to the stone: rather than leave it the weaker of the two (the wax) gives way in part from the base, caused by the well-known pressure of the atmosphere. Wax impressions are made better upon card than on paper; and now we touch the second point. To have the wax in a good condition, first warm the card, holding it about half an inch above the wick of a well-snuffed candle. Now melt the wax gradually, not by putting the wax into the flame, for by so doing black streaky impressions are obtained, but by holding the wax just at the top point of the flame, at which place there is more heat than in the flame. When the wax is sufficiently melted and nearly ready to drop, *place the* fluid portion on to the card, moving the

fluid wax from the stick with a circular motion. Twice melting is almost certain to be enough; take care, however, to spread the wax out to the full size of the impression required.

In taking a copy of a coin it will be difficult to do so perfectly unless one side be fixed to a temporary handle. This can be done by making a wooden handle, and fixing the same to the reverse side with sealing wax. Cut a short wood handle, make one end hot, then put melted sealing-wax upon it; next warm the coin, and put sealing-wax upon it; now warm the two, and weld the wax together. When cold enough the impression can be taken. Never wet or damp a seal before taking an impression; the hot wax converts the water into steam, and is sure to spoil the impression.

210. *Palmistry—Telling Fortunes by Lines in the Hand.*

Always choose the left hand. One of the lines, and which indeed is reckoned the principal, is called the line of life; this line encloses the thumb, separating it from the hollow of the hand. Next to it the natural line takes its beginning from the rising of the middle finger. The table line, commonly called the line of fortune, begins under the little finger and ends near the fore-finger. The girdle of Venus, another line, begins

near the joint of the fore-finger, and ends in the middle finger. The line of death is a counter-line to the line of life, and is by some called the sister line. There are also lines in the fleshy part, as in the ball of the thumb. If the lines which are in the middle of the hand, and are called the table lines, are broad and fair, without being broken, the party will lead a happy and comfortable life. If the line from the wrist goes straight up to the little finger, it is a better sign than if broken, for then it denotes the party will live to a good old age; but on the contrary, should the line want continuation, he is in danger of sudden death. If the line of life, which is that which runs from the wrist by the ball of the thumb, and ends under the fore-finger, is clear, and ends without breaks; it denotes possession, prosperity, and happy old age. Round lines, like semi-circles on the inside of the tips of the fingers, promise houses, lands, and inheritance. As many lines or crosses as a woman has in her wrist, so many children she may expect to have. If the middle, or table lines in the hand, are very narrow and contracted it is a sign of poverty and crosses in the world. If a crooked line goes through the table line, it is a sign of sudden death; but if it runs straight through, it is a good sign. If the line of fortune strikes from behind the ball of the thumb, or mount of the forefinger across the palm and line *of life, and* loses itself in or near the soft or fleshy

part of the hand on the little finger side, it is a sure sign of fortune through some unexpected friend.

Solution to Geometrical Magic at p. 252.

The annexed sketches show the original window and how the alteration may be made, retaining the present arch and sill, and filling up the spaces

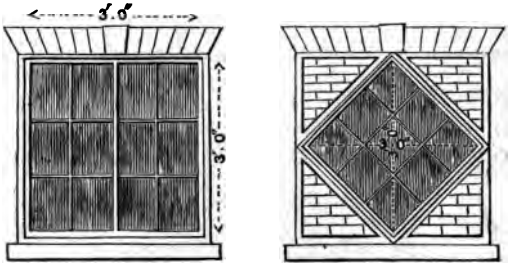


FIG. 35.

with raised brick panels. Founded upon Euclid's proposition that a triangle is always half of a parallelogram when upon the same base and between the same parallels.

211. *Experiment for producing Living Creatures.*

Make a thin paste by boiling a little of the best flour in water; when the paste is cold, stir in a few drops of vinegar; now set the jar containing the ingredients where the temperature is *equable*, and at summer heat. In from four to

seven days the paste will be found teeming with vitality, and on examination of a drop with a powerful magnifying glass, such as a Stanhope lens, living creatures will be seen moving about with the contortions of an eel. In England, during July and August, this wonderful experiment rarely fails. The paste, when made, should be about the consistence of thin gruel.

Solution to Magical Square Problem, p. 174.

0	0	0	34	40	39	Age of innkeeper, 79, age
0	0	0	42	38	34	of the youngest gentleman
0	0	0	37	36	41	who occupies the centre, 38

212. *The Torn Card restored.*

This trick deserves and always receives an *encore*; you will therefore be careful to attend to the hint given in No. 4. To those who witness this illusion for the first time, it is a perfect climax to the Magic Art, and in effect surpasses every other; we therefore reserve it for the *finale* of our evening's amusement.

To restore *part* of an article that has been destroyed, appears more inexplicable than to reproduce a whole one, because when anything is restored whole, many persons will imagine a *duplicate* is shown in place of the original; but when, for instance, a card is promiscuously torn,

and the tearer retains (as he thinks) one of its pieces, and finally sees the remainder made whole saving and except the piece retained, it does certainly require 'a puzzling cap' to solve the mystery—but here it is.

To exhibit this pleasing trick, we take a pack of cards, asking one of the company to choose one, they do so; we now request them to tear up the chosen card, with regret and trepidation of 'spoiling the pack' this is done; we now say,

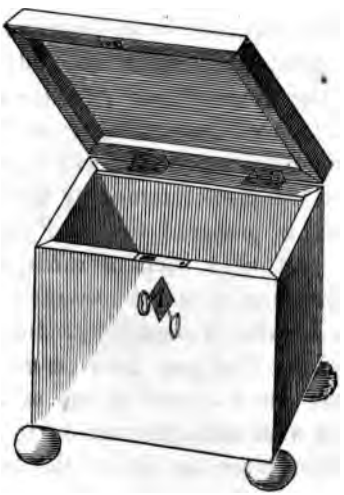


Fig. 36.

put the pieces into this chest (Fig. 36), this being done, we shut and lock it. Oh! I wish *you to keep* one of the pieces; and opening the

chest again, say—take out a piece; now close the box and give some one the key, place the box on the table and then deliver a three minute lecture on the 'Origin of Magic;' how practised by the Egyptians 4000 years ago; fall out with the astrologers and charlatans of the Merovingian and the Carlovingian periods; fall in with the alchymists and searchers for the elixir of life; then by a few selected figures in rhetoric connect the whole with the modern discoveries of gas, photography, and steam; revert to the oracles of Delphos; the superstition and witchcraft of the mediæval ages; and finally conclude with an allusion to the telegraph and Atlantic cable. By this time it is meet that the card should be restored; so opening the chest it will be found complete all but the piece retained by the tearer.

This trick is prepared thus:—First we have a pack or part of a pack of cards, all of one suit* (an entire pack is not necessary, for twenty cards or so are always enough to induce an audience to believe that you have an entire pack). We now tear out a corner of one of them, and put the card with its corner out on to the fall A (Fig. 37), then place the fall to the back of the box, holding it there with the catch B; this catch is of wire, and passes up the corner of the chest from the ball-foot bent at right angles as

* See No. 3.

in figure: it is made to slide easily, like a small bolt that can be slid with one finger.

Now we place the corner of the card on to the fall D, and then fix that to the back of the chest in a similar way by the catch E, which is worked from the opposite corner, the chest will

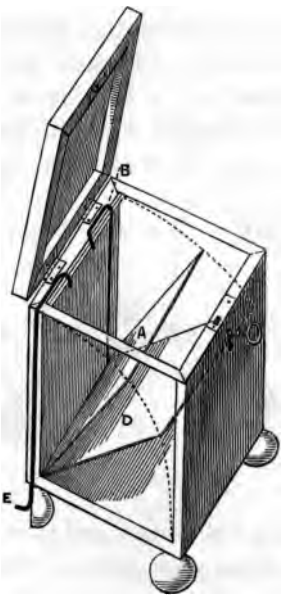


FIG. 37.

then appear 'all square' as in Fig. 36. When the trick is shown the person who tears the card is to place the real pieces in the bottom of the chest, then during our act of shutting and locking

it, we release the catch E by pressing on it with the middle finger, the box being at the time held in the left hand, this lets the fall D drop on to the real pieces of the torn card, covering them up as it were with a false bottom, which in reality it then becomes. The corner piece previously placed on to the fall D is of course now exposed, and if a hand be put into the chest, this piece is sure to be withdrawn, because it is loose and easily taken hold of; a few pieces of real card glued flat on to this fall is useful for appearance sake, should the 'wicked eyes' want to look in the box.

We now say — 'We will begin the trick!'

FIG. 38.

(*you* know it is half done), and then shutting the box again, release the catch B; the fall A now drops forward on to the bottom of the box, and exposes the card entire save and except the piece previously drawn, Fig. 38.

Having requested the company to see that the two pieces 'match,' you retire with all *the unassuming* grace of an ADEPT IN THE

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Lookers-on feel most delight
That least perceive the juggler's sleight;
And still the less they understand
The more they admire his sleight of hand.

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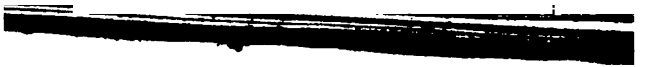

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